May 1984

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Issue No 26

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FEATURES

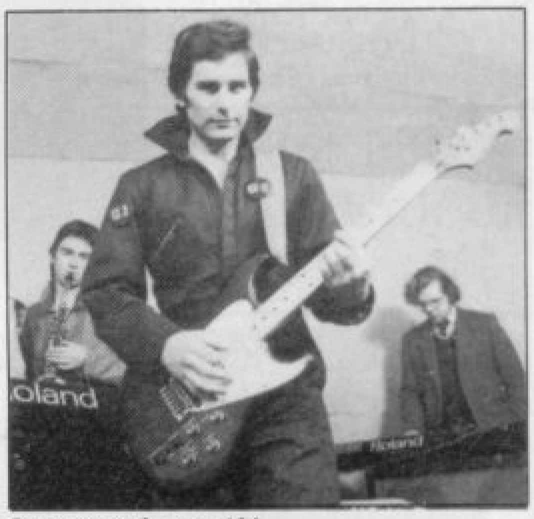


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REGULARS

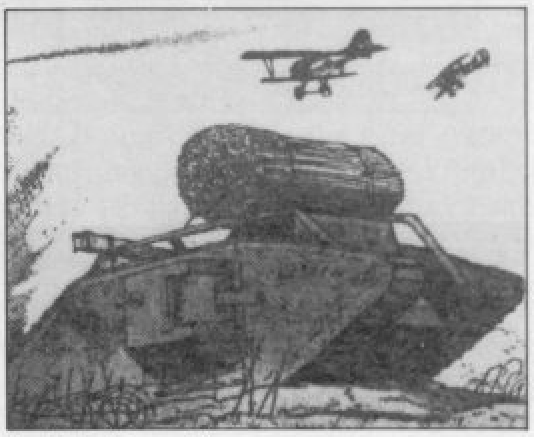


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PLUS



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The writing on the wall

IT IS a widely-held belief that whatever happens in the United States will, sooner or later, happen on this side of the Atlantic. If that is so, we must view with some anxiety the sudden withdrawal of Timex from the home computer market in the U.S., a withdrawal announced with a somewhat ominous prediction from Mike Jacobi, vice-chairman of marketing and sales at Timex: "We believe instability in the market will cause the value of inventories to decline, making it difficult to make a reasonable profit."

That portentious statement refers to the price-cutting war waged recently in the States, a war which claimed several dead and not a few wounded, and which continues to influence the marketing strategies of those micro manufacturers fortunate enough to survive.

When Sinclair Research introduced the ZX-81 in the U.S. it was welcomed with immediate, if moderate success, selling an estimated 500,000 machines by the spring of 1982, at which point Sinclair handed the marketing to Timex. Six months later Timex launched its version of the ZX-81, the TS-1000, which proved to be even more popular than its predecessor. In three months 600,000 units were sold, securing for Timex a staggering 25 percent of the total U.S. home computer market. So far, so good.

> 'In the long run it should result in a more stable, more mature computer industry'

Bouyed by such an achievement, the company predicted confidently at least a doubling of unit sales in 1983. The optimism was shared by others, among them Mattel, Commodore, Atari and Texas Instruments. A year later only two of those companies would still be manufacturing home computers, and only one, Commodore, would not have sustained enormous losses.

The move towards chaos in the market was initiated by Texas Instruments, which made a bid to secure a large share of the market by reducing its prices drastically to compete with Atari and Commodore; cutting them so low, in fact, that the TI 99/4a was selling for $20 less than it cost to produce. In October, 1983 Texas Instruments decided to cut its losses — more than $500 million for the year — and withdraw. Mattel Electronics had already reached a similar decision a month earlier. Atari sustained losses of the same magnitude but survived, bloody but unbowed, and now refuses to be drawn into another price war, instead increasing its prices by $40 a machine. Only Commodore emerged victorious, achieving record sales and appearing well set for continuing success.

> 'At least 25 percent of personal computer owners no longer use them'

An uneasy peace prevails but for Timex it has arrived too late. During 1983 sales of the new computer, the TS-1500, were poor and even the big discounts offered on the TS-1000 before Christmas, when it sold for as little as $15, did nothing to maintain the Timex share of the market. The latest machine, the TS-2068, barely got off the ground.

Where does all that leave Sinclair Research? It seems likely that the company will forego the low end of the market and concentrate on selling the QL, which at $499 should appeal to buyers who increasingly are expecting more from their computers. The company plans at first to sell through its traditional mail order policy, though it will have to opt for stronger promotion than it exercised in the U.K. where, it seems, Sir Clive has only to announce the ghost of an idea for consumers to be falling over themselves to e first in the queue.

As for stability in the British market, the shakeout has already begun, with Grundy and Jupiter Cantab the first casualties. In almost every direction companies are falling by the wayside. Distributors, software houses and add-on manufacturers are all feeling the pinch and even Sinclair Research disclosed disappointing profits for the first six months of the last financial year.

If all that sounds gloomy, in the long run it should result in a more stable, more mature, computer industry which must be good news for the consumer. The less professional fly-by-night companies will disappear or be amalgamated into larger, more viable concerns, and the consequent tightening of standards will ensure that the buyer has his money's worth. As Mark Eyles of Quicksilva sums up: "The computer industry has grown to the size where you have to have a fairly stable business-like approach to survive."

There is, however, a nagging suspicion that the worst is yet to follow. It has become apparent in the States that all is not well with the consumers. Research prepared for the U.S. magazine *Infoworld*, in November, 1983 revealed that at least 25 percent of personal computer owners no longer used them. The percentage was even higher among those who had owned a micro for less than six months. Another illuminating fact was that the less expensive the computer, the less it was being used. Of those who had paid less than $300 for their machines, half had ceased to use them.

> 'It has become apparent in the States that all is not well with the consumers'

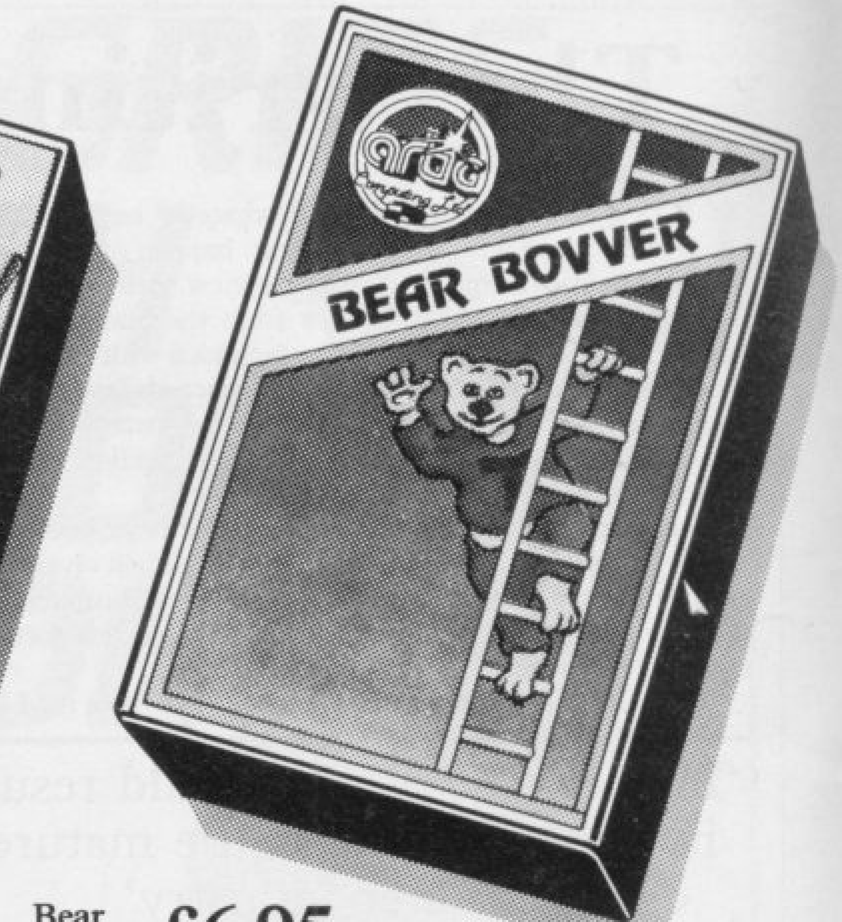
Reasons for the micro-in-the-wardrobe syndrome centred on false expectations on the part of the purchaser. Many bought computers only to find the claims made of its as an indispensible home aid to be greatly exaggerated, as it was little more to them than a glorified games machine which they soon grew tired of using.

Does that signify that all now caught in the latest craze to follow the now extinct hula hoops and pogo sticks? Probably not, for though computers are not yet essential in the home they soon will be, as networks, databases, electronic funds transfer and electronic mail come into their own. Games will then be the side product, not the mainstay, of the industry.

In the meantime, if your Spectrum is gathering dust under the stairs, side by side with the frisbees, skateboards and roller skates, you had better keep quiet about it. It would never do, after all, to criticise the Emperor's new clothes, would it?



Jet Set Willy £5.95

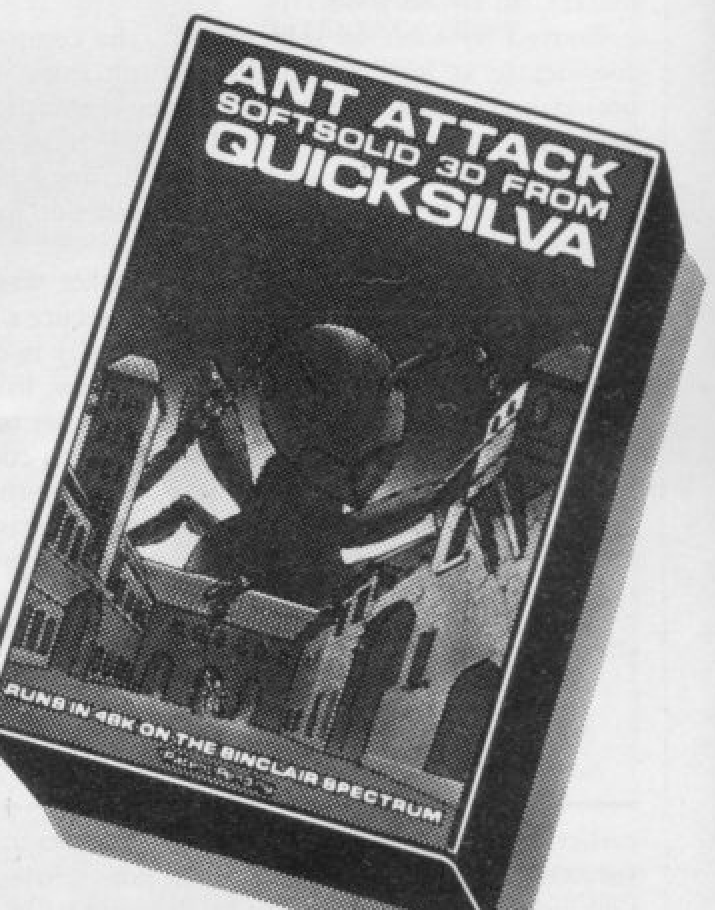


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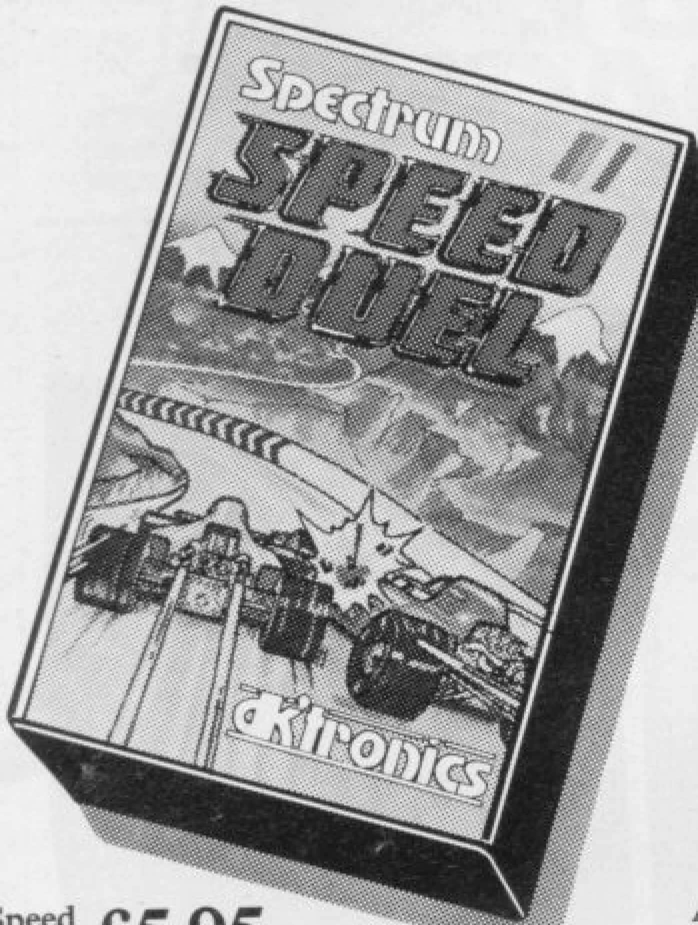
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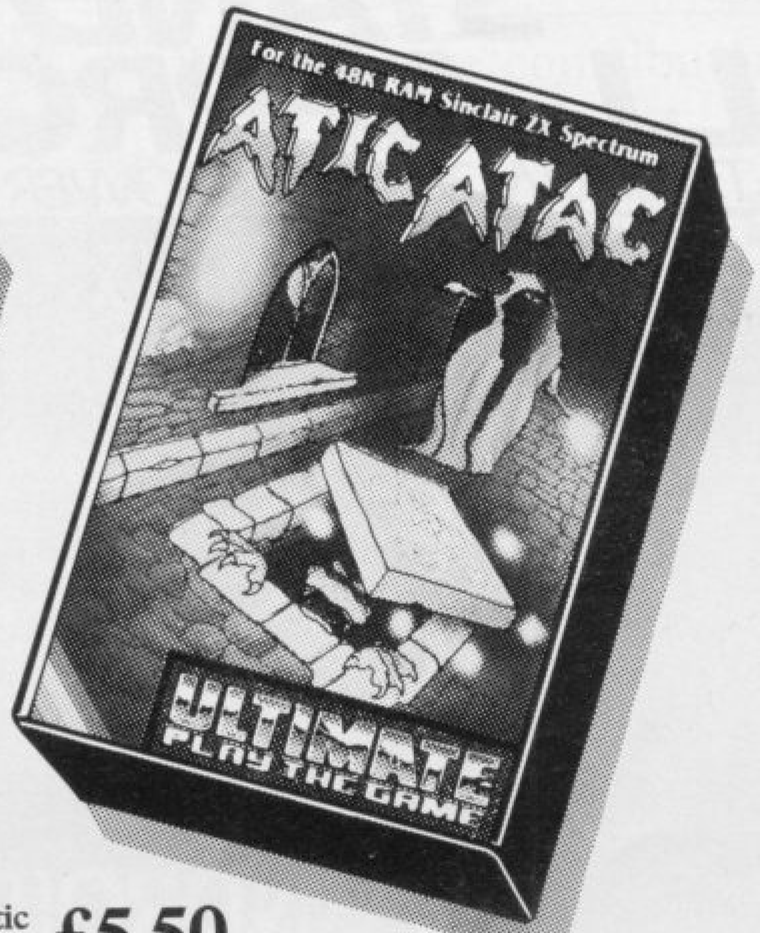
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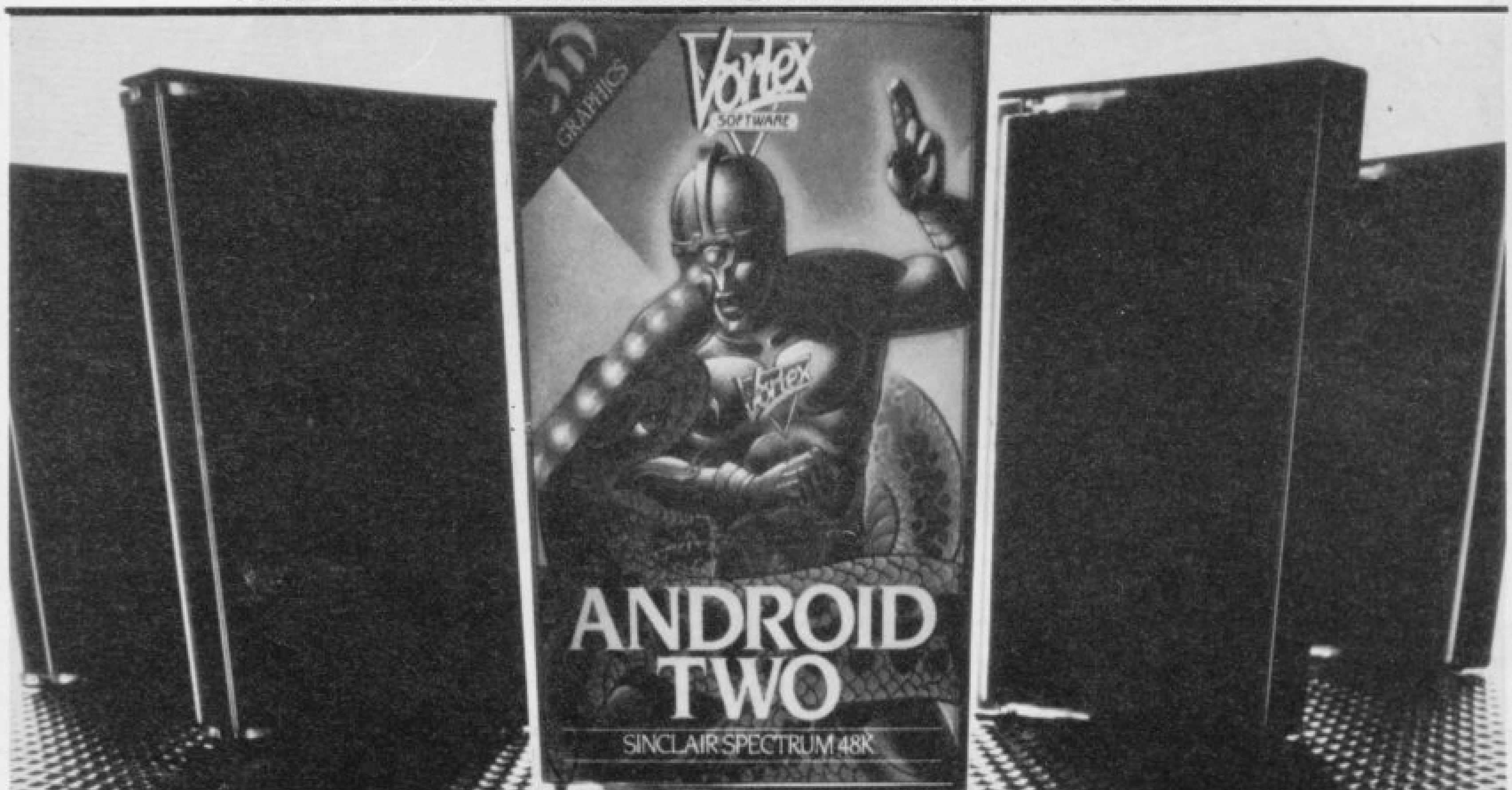
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3D bargains

THIS MONTH the Club can offer software and hardware at a reduced rate. The hardware consists of the **RD Digital Tracer** which is suitable for the Spectrum and the ZX-81. The tracer is like a mechanical arm which can be run over the lines of a picture, map or photograph.

The software on offer includes the full range of 3D games for the ZX-81 from New Generation. **3D Monster Maze** takes place in the corridors of an ancient maze in which a terrifying dinosaur plods around. When you hear it coming you had better run or you will be eaten as the monster approaches and opens its mouth. **3D Defender** was one of the first games to use three-dimensional spaceships.

Black Star, from Quicksilva, is also a 3D game. When playing it you might be reminded of the Death Star in **Star Wars.**

For the Spectrum we have a range of software from dK'tronics.

All offers can be obtained only by Club members and are available until the end of May.

CLUB OFFER

If you are not a member but intend to join this month, you can take advantage of the hardware and software. Send an order with your membership fee.

	List price	Offer price
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Club software contributor on the road to success

Micro mania pays off

CLUB NEWS

ONE OF the more pleasant tasks encountered when organising the Sinclair User Club is to report on any member who has achieved a reasonable level of distinction in their chosen hobby. That must surely apply to Chris Hinsley.

Club members will recognise the name as being one of our regular software contributors on the club cassette. The excellent **Scramble** program on the February tape is one example.

Hinsley says he first became interested in computers after visiting the terminal room at St Bede's Grammar School, Bradford. It was after that he decided to take O level computer studies but found that the course was full. He decided to study in his own time and after three months managed to pass the subject with a top grade. He admits that while studying for A level examinations computer mania set in. He and a close friend, Andrew Pizcazub, used regularly to spend up to 24 hours a day in front of a ZX-81 learning machine code. Initially that proved a difficult task but the club help-line assisted him to become proficient in the language. By the winter of 1983-84, he had experience of programming several machines in machine code — Z-80, 6502, 6809 — and had written a number of games for the ZX-81 and Spectrum.

He then obtained a place at Derby college on an HND computer studies course. Although he enjoyed college life, he experienced an urge to concentrate on his programming career and last Christmas decided to leave college and join a well-known software company.

When asked about his plans, Hinsley says he would like to be the best computer games writer in history — and to make a great deal of money.

MEMBERSHIP FORM

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Sinclair User Club

Britain

Aylesbury Computer Club: 12 Long Plough, Aston Clinton, Aylesbury, Bucks.

Aylesbury ZX Computer Club: Ken Knight, 22 Mount Street, Aylesbury (5181 or 630867). Meetings: first Wednesday and third Thursday of the month.

Basildon: Roundacre Microcomputer Users' Club. J Hazell, Basildon 285119/416333. Meetings every Wednesday 7.30 to 10.30pm.

Bristol Yate and Sodbury Computer Club: 99 Woodchester Yate, Bristol, BS17 4TX.

Cardiff ZX Club: Steve Smith (0222) 593237 or Mike Hayes (0222) 371732. Meets twice a month.

Colchester Sinclair User Group: Richard Lown, 102 Prettygate Road, Colchester CO3 4EE.

Crewe and Nantwich Computer Users' Club: J E A Symondson, 46 London Road, Stapeley, Nantwich, Cheshire CW5 7JL.

Doncaster and District Micro Club: John Woods, 60 Dundas Road, Wheatley, Doncaster DN2 4DR; (0302) 29357. Meetings held on second and fourth Wednesday of each month.

Eastwood Town Microcomputer Club: E N Ryan, 15 Queens Square, Eastwood, Nottingham NG16 3BJ.

Edinburgh: Edinburgh Home Computing Club. John Palmer (031 661 3183) or Iain Robertson (031 441 2361).

EZUG-Educational ZX-80-81 Users' Group: Eric Deeson, Highgate School, Birmingham B12 9DS.

Furness Computer Club: R J C Wade, 67 Sands Road, Ulverston, Cumbria (Ulverton 55068). Meets every other Wednesday.

Glasgow ZX-80-81 Users' Club: Ian Watt, 107 Greenwood Road, Clarkston, Glasgow G76 7LW (041 638 1241). Meetings: second and fourth Monday of each month.

Gloucester: Mid-weekly Spectrum User Group. Barry Ledbury, 8 Linnet Close, Gloucester GL4 9XA (0452) 23186.

Gravesend Computer Club: c/o The Extra Tuition Centre, 39 The Terrace, Gravesend, Kent DA12 2BA. Bi-monthly magazine and membership card.

Hassocks ZX Micro User Club, Sussex: Paul King (Hassocks 4530).

Inverclyde ZX-81 Users' Club: Robert Watt, 9 St. John's Road, Gourock, Renfrewshire PA19 1PL (Gourock 39967). Meets every other Monday at Greenock Society of the Deaf, Kelly Street, Greenock.

Keighley Computer Club: Colin Price, Redholt, Ingrow, Keighley (603133).

Lambeth Computer Club: Robert Barker, 54 Brixton Road, SW9 6BS.

Liverpool ZX Club: Meetings every Wednesday 7pm at Youth Activities Centre. Belmont Road, Liverpool 6. Details from Keith Archer, 031-236 6109 (daytime).

Manchester Sinclair Users' Club: Meets every Wednesday, 7.30pm, at Longsight Library, 519 Stockport Road, Longsight — 061-225 6997 or 061 445 6316.

Meopham: National ZX Spectrum User Club. Guy Fullalove, Woodcotes, Camer Park, Meopham, Kent DA13 0XS. Bi-monthly newsletter, subscription £1.50. Send SAE for details.

Merseyside Co-op ZX Users' Group: Keith Driscoll, 53 Melville Road, Bootle, Merseyside L20 6NE; 051-922 3163.

Micro Users' Group: 316 Kingston Road, Ewell, Surrey KT19 0SY.

Mid-Kent Micro Club: Meets once monthly. Enquiries to M Gates, 65 Buckland Road, Maidstone ME16 0SH.

Newcastle (Staffs) Computer Club: Meetings at Newcastle Youth and Adult Centre, Thursday, 7.30. Enquiries to R G Martin (0782 62065).

North Hertfordshire Home Computer Club: R Crutchfield, 2 Durham Road, Stevenage; Meetings: first Friday of the month at the Settlement, Nevells Road, Letchworth.

Northern Ireland Sinclair Users' Club: P Gibson, 11 Fitzjames Park, Newtownards, Co Down BT23 4BU.

North London Hobby Computer Club: ZX users' group meets at North London Polytechnic, Holloway Road, London N7 Monday, 6pm.

Nottingham Microcomputer Club: ZX-80-81 users' group, G E Basford, 9 Holme Close, The Pastures, Woodborough, Nottingham.

Orpington Computer Club: Roger Pyatt, 23 Arundel Drive, Orpington, Kent (Orpington 20281).

Perth and District Amateur Computer Society: Alastair MacPherson, 154 Oakbank Road, Perth PH1 1HA (29633). Meetings: third Tuesday of each month at Hunters Lodge Motel, Bankfoot.

Regis Amateur Microcomputer Society: R H Wallis, 22 Mallard Crescent, Pagham, Bognor Regis, West Sussex PO21 4UU.

Roche Computer Club: 8 Victoria Road, Coop Rooms, Roche, Cornwall: 0726 890473.

Scunthorpe ZX Club: C P Hazleton, 26 Rilestone Place, Bottesford, Scunthorpe; (0724 63466).

Sheffield: South Yorkshire Personal Computing Group. Enquiries to R Alderton (0742 20571), S Gray (0742 351440), P Sanderson (0742 351895).

Sinclair Amateur Radio User Group: Send SAE or two IRCs for details. Paul Newman G4 1NP, 3 Red House Lane, Leiston, Suffolk IP16 4JZ.

Sittingbourne: Anurag Vidyarth (0795 73149). Would be interested to hear from anyone who wants to start a club near the Medway towns.

St Albans: Bi-monthly meetings and a magazine. Details from Adam Slater, 40 Watford Road, St Albans, Herts AL1 2HA. (0727 54176).

Stratford-on-Avon Computer Club: Meets on the second Wednesday of every month. Telephone: 0789 68080 for details.

Swansea Computer Club: B J Candy, Jr Gorlau, Killay, Swansea (203811).

Swindon ZX Computer Club: Andrew Bartlett, 47 Grosvenor Road, Swindon, Wilts SN1 4LT; (0793) 3077. Monthly meetings and library.

Sutton: Sutton Library Computer Club, D Wilkins, 22 Chestnut Court, Mulgrave Road, Sutton, Surrey SM2 6LR.

West Sussex: Midhurst and District Computer User Group. Enquiries to V Weston (073 081 3876), R Armes (073 081 3279).

Worle Computer Club: S W Rabone, 18 Castle Road, Worle, Weston-super-Mare BS22 9JW (Weston-super-Mare 513068). Meetings: Woodsprings Inn, Worle, on alternate Mondays.

ZX-Aid: Conrad Roe, 25 Cherry Tree Avenue, Walsall WS5 4LH. Please include sae. Meetings twice monthly.

Overseas

Austria: ZX User Club, Thomas Christian, c/o Wissenschaft Forscht e. V., Postfach 141, A1190 Vienna. Meets every first Friday of the month. Telephone 0222-44 32 050 for details.

Belgium, France and Luxembourg: Club Micro-Europe, Raymond Betz, 38 Chemin du Moulin 38, B-1328 Ohain, Belgium (32/2/6537468).

Denmark: Danmarks National ZX-8081 Klub (DNZK), Jens Larson, Skovmosevej 6.4200 Slagelese, post giro 1 46 24 66.

ZZ-Brugergruppen i Danmark, Boks 44, 2650 Hvidovre, Gratis medlemskab og gratis blad til enhver interesseret.

J Niels-Erik Hartmann, OZ-ZX-Radioamator, Bruger Gruppe, Bredgade 25 DK-4900, Nakskov.

East Netherlands: Jonathon Meyer, Van Spaen Straat 22,6524 H.N. Nijmegen; (080 223411).

Germany: ZX Club, a postal club; contact Aribert Deckers, Postfach 967, D-7000 Stuttgart 1, West Germany.

Indonesia: Jakarta ZX-80/81 Users' Club, J S Wijaya, PO Box 20, Jkukg, Jakarta, Utara, Indonesia.

Irish Amateur Computer Club: Martin Stapleton, 48 Seacourt, Clontarf, Dublin 3. (331304).

Irish Sinclair Users Club: PO Box 1238, Dublin 1. Publishes a newsletter. Send SAE for details.

Italy: Sinclair Club, Via Molino Vecchio 10/F, 40026 Imola, Italy.

Genova Sinclair Club; Vittorio Gioia, Via F Corridoni, 2-1, telephone 010 3125 51.

Micro-Europe: Belgium or Club Paris-Micro, 19 Rue de Tilly, 92700, Colombes, France; associated with Club Micro-Europe.

Republic of Ireland: Irish ZX-8081 Users' Club, 73 Cnoc Crionain, Baile Atha, Cliath 1.

Singapore: Sinclair Users' Group: Eric Mortimer, 1D Wilmer Court, Leonie Hill Road, Singapore.

South Africa: Johannesburg ZX-80-81 Computer Users' Club: S Lucas, c/o Hoechst SA (Pty) Ltd, PO Box 8692, Johannesburg.

Johannesburg ZX Users' Club: Lennert E R Fisher, PO Box 61446, Marshallstown, Johannesburg.

Dumont and Syndercombe Amateur Computer Club. Jean-Pierre Dumont would like to correspond with ZX-81 owners via tapes. Write to 8 Kipling Road, Farrarmere, Benoni 1500, Transvaal.

ZX SA Club: Jonathan Jones, House 14, Anglo Alpha PO Box 15, 1725 Roodepoorf.

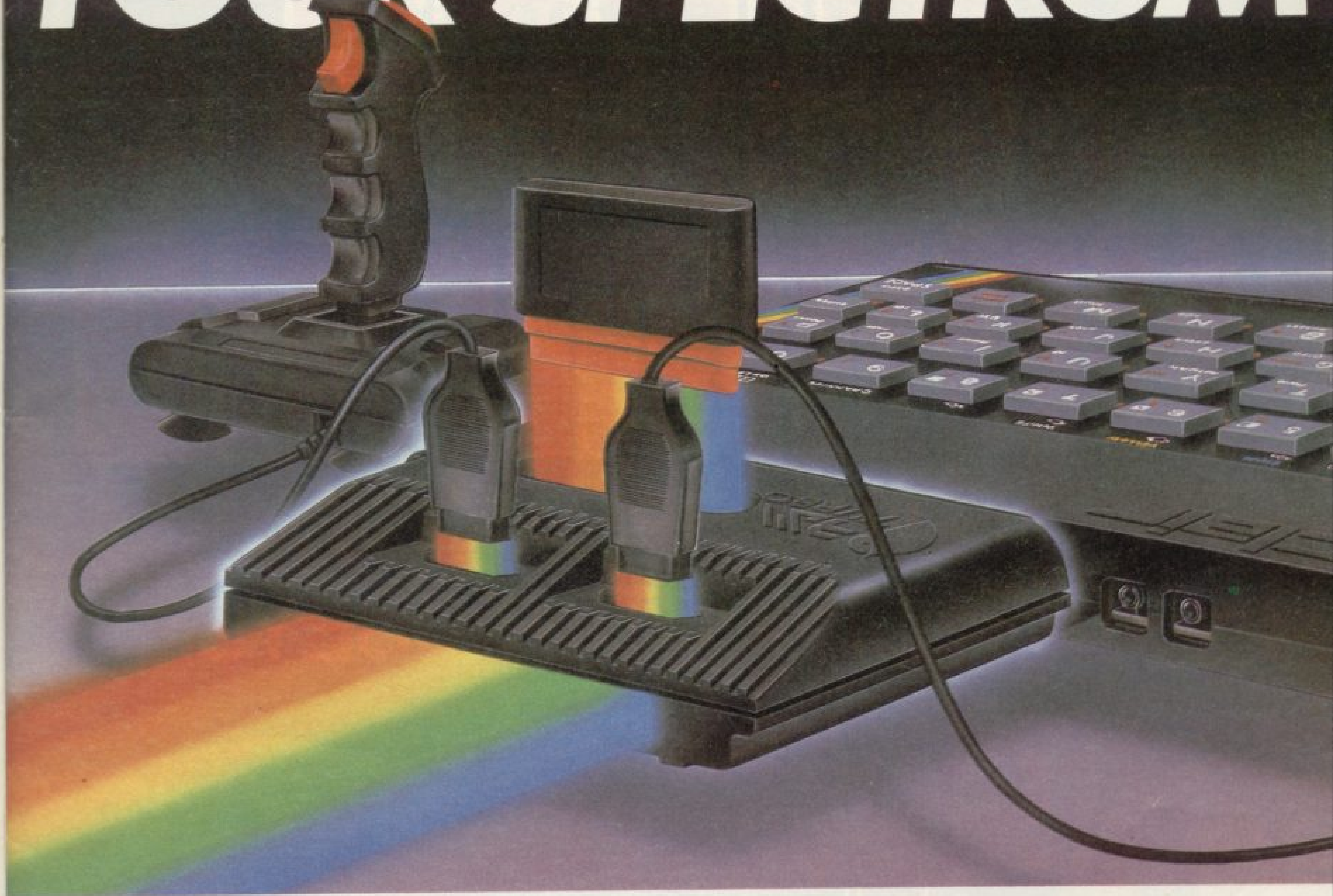
Spain: Club Nacional de Usuarios del ZX-81, Joseph-Oriol Tomas, Avda. de Madrid, No 203 207, 10, 3a esc. A Barcelona-14 Espana. International ZX Spectrum Club: Gabriel Indalecio Cano, Sardana, 4 atrico 2a, San Andres de la Barca, Barcelona. Send international reply coupon. Produces a bi-monthly magazine. Spanish ZX Micro Club: Apartado 181, Alicante (Costa Blanca), Spain.

ZX Club Spain; C Benito PO Box 3253, Madrid, Spain.

Swedish ZX-club: Sinclair Datorklubben, Box 1007, S-122, 22 Enskede.

United States: Bay Area ZX-80 User Group, 2660 Las Aromas, Oakland CA94611.—Harvard Group, Bolton Road, Harvard MA 01451: (617 456 3967).

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Vehicle deal for Hoover

THE SINCLAIR Vehicle Project, researching into the electric car, has confirmed that it is negotiating with Hoover regarding the assembly of its first electric car.

It will be assembled under subcontract at the Hoover plant at Merthyr Tydfil. Sinclair had been negotiating to take over the De Lorean car factory in Northern Ireland but a company spokesman, Barrie Wills, head of the SVP, says:

"The Hoover advanced high-volume assembly capacity and considerable experience with electrical products are ideal for this project."

The first of the Sinclair family of electric vehicles is planned for launch in late 1984 or early 1985, depending on progress of negotiation concerning manufacture.

No chips — no problem

THE WORLD shortage of microchips has worsened and, as a result, prices have risen. Sinclair Research, however, stresses that the situation has not affected its production either of microcomputers, such as the Spectrum or the QL, or peripherals, such as Interface One. A spokesman for the company says:

"We are having no problems. There is an acute shortage of chips in the world but if people take that into account and order about six months in advance they should have no difficulty.

"If, however, a company orders supplies overnight, they will have difficulty. One would certainly occur if a company underestimated its chip needs. It would be unlikely that it could get supplies quickly."

Dealers set to lose as Imagine cuts prices

IMAGINE SOFTWARE has reduced the retail price of all its products to £3.95. The reduction even includes its new release, **Pedro,** for the 48K Spectrum and future software developments. A spokesman for the company says:

"We think we should pass the profits we have made in the last year to our customers who, we feel, are paying too much for software at the moment."

Other software houses do not believe the reduction will lead to a price-cutting war. A spokeswoman for Melbourne House, publisher of **The Hobbit,** says: "We certainly would not reduce our prices. We have to pay the salaries of our staff. If Imagine wants to cut its prices that is up to Imagine but our prices are very fair and we shall keep to them."

The same is true of Quicksilva. A spokesman for that company says: "We do not need to cut our prices."

W H Smith, one of the biggest retailers of computer software, is not concerned about the price cuts. A spokeswoman says: "We get along perfectly well with Imagine. It is one of the biggest and most successful software houses so it must know what it is doing. Dealers who have bought large stocks before the prices went down might be angry but we do not hold too much stock of any of the lines."

The Guild of Software Houses does not share that view. Mike Johnston, secretary of the association, says: "It is potentially damaging to the industry. It will cut margins for profit and there will be less money for development. It is, of course, for people to take whatever action they think is necessary but we will be considering our position very carefully."

Meanwhile, Imagine is having problems due to the termination of an agreement with publisher Marshall Cavendish to provide software for a part-work called *Input.* The company was to have produced 30 programs for the publication but Marshall Cavendish rejected them. That leaves the company with only a few new programs. A spokesman for Imagine says:

"Marshall Cavendish decided that it did not want to publish the programs with the part-work. The company did not think it would be suitable to do so."

Colin Stokes, former sales manager of Imagine, has been dismissed by the company for allegedly commenting on the 'financial state of Imagine to rival companies or individuals'. An injunction was sought against Stokes to prevent him disclosing information or starting a rival company.

Stokes, who now works for Software Projects, disputes the validity of the contract which he signed with Imagine as it prevents him setting-up his own rival company after leaving Imagine.

More news page 15



Hours and hours and hours . . .

THE WINNER of the £500 Splat! competition organised by Incentive Software for one of its games is 17-year-old James Tant. The object was to achieve the highest score with Splat, a maze game where the maze moves. The scores were checked using a hi-code generator built into the program which produced a code for each score.

Tant attained a massive 112,930 points and when he visited the Incentive offices to verify the score he did even better. His secret was between five and seven hours on the game every day for three months.

Hundreds of entries were received according to Incentive. The lowest score was 520 points and the average was around 10,500.

The new Incentive competition is to find the first person to complete the **Ket Trilogy** of adventure games. The prize will be a video recorder.

Timex moves out after watch on computer trade

TIMEX, watchmaker and former distributor of Sinclair computers in the United States, has withdrawn from the computer market. The move has left Sinclair Research with the opportunity to expand its operation in the States and of introducing its marketing strategy there. Sinclair Research, however, has no plans to introduce the Spectrum to the American market.

A spokesman for Timex Corp explained the reasons for the withdrawal. He says that 1984 will be a year of turmoil in the market. "We believe instability in the market will cause the value of inventories to decline, making it difficult to make a reasonable profit."

Timex also believes that the instability of the market will cause a strain on trade relations between retailers and manufacturers. Other Timex product lines are doing well, according to the company, so it can divert money marked previously for the computer market to other divisions of its business.

Sinclair Research sees it as unlikely that any of the problems cited by Timex will affect it. A spokesman for the company says: "Sinclair Research does not believe that the so-called instability will affect the QL market."

Stack tower to rise as add-on company falls

BASICARE, the company which produced the stack modules for the ZX-81 and Spectrum, has gone into voluntary liquidation. The move resulted partly through financial problems and because one of the partners wanted to do other things, according to Peter Choy, the other partner in the company. He says:

"Benny Leung did not want to continue with Basicare and as part of our agreement we decided to go into liquidation.

"I have the technical knowledge in the company, so I will be continuing to build the modules and sell them through a different company."

The modules include one which contains David Husband's ZX-81 Forth. That will be used for control applications. It will be a unit to complete the stack tower for which Basicare is famous but it will also be possible to use it alone.

Test run for Romox

THE ROMOX electronic software distribution system, from Prism Technology, has begun initial test operation in chain stores round the country. The Romox is a cartridge ROM system with a difference. The customer inserts a blank cartridge into the machine, which then programs it with a piece of software. The customer can take home the newly-programmed cartridge and, when finished with it, can return it to the store to be re-programmed with a new piece of software.

At first, Romox is likely to go to retailers which have had previous dealings with Prism. They include W H Smith, Boots and Dixons and the stores are likely to be situated in the affluent south-east of England. Prism is distributing 40 titles for the Romox but the list of titles will be increased as more prime U.K. software houses make agreements with Prism to have their software channeled on to ROM cartridge.

Prism will not be short of American inventiveness either, as 300 titles from the States are to be used with the new distribution system.

Prism feels that ROM cartridge offers better security than tape or disc storage. It is almost impossible to pirate copies of programs held on ROM. That will provide an added incentive to software houses wanting to put their software on Romox but who are also security-conscious.

Top Ten

Program	Last Month	Company	Memory
1 Chequered Flag	5	Psion	48K
2 Atic Atac	1	Ultimate	48K
3 Flight Simulation	10	Psion	48K
4 Lunar Jetman	2	Ultimate	48K
5 Cyrus-IS-Chess	—	Intelligent	48K
6 Ant Attack	9	Quicksilva	48K
7 Scuba Dive	—	Durrell	48K
8 Pool	—	CDS	16K
9 Kong	—	Ocean	16K
10 Stonkers	3	Imagine	48K

Figures supplied by W H Smith.

More news page 16



Andrew Hewson

Machine code book a winner

ANDREW HEWSON and John Hardman received the award for the Best Computer Book 1984 at the recent Computer Trade Association Awards ceremony.

The winning book was *40 Best Machine Code Routines for the ZX Spectrum* which, because of its success, is now being published in German and Spanish.

The award was presented by Trade and Industry Secretary John Butcher to Hewson, author of the *Sinclair User* Helpline.

Promises, promises

HAS THE QL finally arrived? At the time of going to press a spokesman for Sinclair Research was confident some customers would receive their computers by the beginning of April, but declined to estimate how many orders would be fulfilled.

The delays have caused a reduction in orders received, though the number is well in excess of 10,000. Customers ordering QLs in March received acknowledgments with expected delivery dates in June, when monthly production should be nearing the promised 20,000 units.

It was also expected that the ZX Microdrive and the Interface 1 were to be made available during April at retail outlets including W H Smith, Boots, Menzies and Prism Microproducts. Sinclair Research is anxious to scotch the myth that Microdrives are difficult to obtain.

Software house fury as MoD bans device

THE GUILD of Software Houses is alarmed because the anti-copying system devised by JLC Data of Barnsley has been seized by the Ministry of Defence.

The device apparently puts a soundtrack over the normal frequencies which make up a program tape and interfere with the tape recorder if someone tries to make illegal copies of a tape. Nick Alexander, chairman of GOSH, says:

"So far, no-one has been able to develop a protection system which works. Because of the Ministry of Defence action it is not possible for us to examine the JLC Data system, but the fact that the Ministry has embargoed it with a secrecy order seems to indicate that it should be taken seriously".

Alexander suggests that if the system works and the Ministry does not release it, the Government should compensate the software industry for the £100 million the industry might lose because of software piracy the system might prevent. He says:

"It seems outrageous that the Government is, by this action, endorsing and giving support to computer pirates, from simple games piracy to industrial piracy".

Meanwhile, Jim Lamont, creator of the JLC device, is trying to side-step the Ministry of Defence and the Patent Office. Patents on the device could be banned until 1985 while the two Government departments decide whether his invention is a risk to British security.

He says that he has an alternative to his anti-piracy device which he does not intend to patent. The only problem is that the device will not be protected from industrial piracy.

The Copyright Reform Group, whose members consist of pressure groups and unions concerned with the way in which copyright laws are enforced, has petitioned the Prime Minister asking that a Bill for a reformed Copyright Law be included in the 1984-85 legislative programme.

Members of the newly-formed group include GOSH, Equity, the Musicians' Union and the British Copyright Council.

Sinclair invades Korea

THE ZX-81 and the Spectrum will soon be available in South Korea, following an agreement between Sinclair Research and Samsung Electronics.

The agreement is effective immediately and the first products are expected to arrive on the Korean market later in the year. The computers will be assembled and distributed locally.

Sir Clive Sinclair, chairman and chief executive of Sinclair Research, signed an agreement with the president of Samsung in London. He says:

"The link gives us access to a market of considerable potential and the comprehensive support of a powerful and highly-experienced partner".

The ZX-81 and the Spectrum each have achieved one million sales world-wide. They are available in more than 50 countries.



Play with a Griffin

So they take school in their stride



Fisons plc Scientific Equipment Division

Your children are using a computer at school far more often than you think.

Computers make learning an absorbing game and retain a child's interest and participation.

Griffin Software have selected and adapted for home use, a series of Griffin educational software titles already used in schools.

The first six titles suitable for 4 to 8 year olds, are available now.

If you have a ZX Spectrum 48K or a BBC Model B microcomputer at home, you can so easily keep up the school's good work. And the beauty of it is, the child sees it as a game!

Wordspell helps with spelling; Tablesums unravels the mysteries of tables; Fairshare uses Ollie the Octopus to make sense of division; Numberfun makes addition and subtraction easy; Wordgames helps with spelling and expands vocabulary; and with Getset a child is helped with counting.

All good fun!

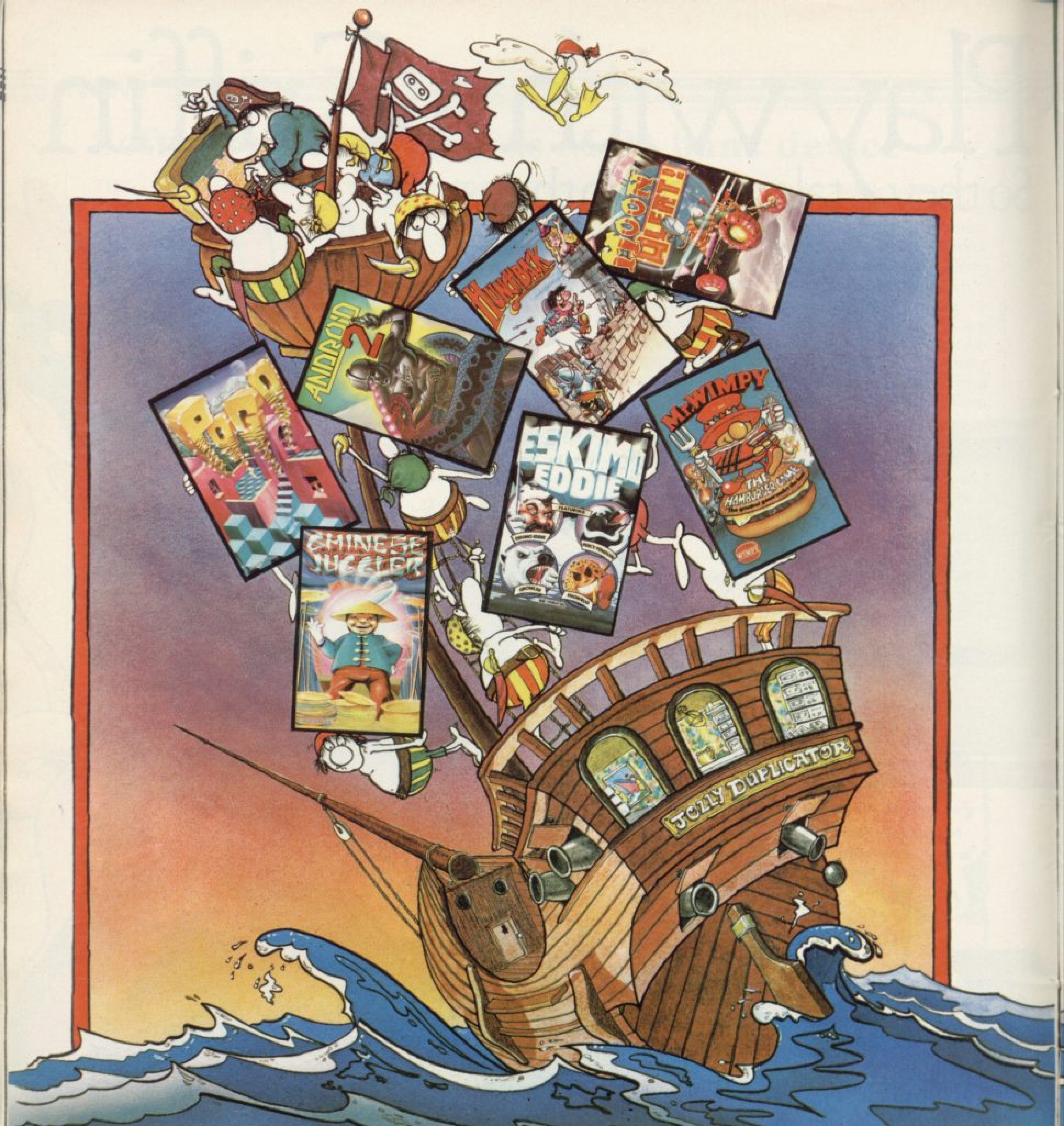
Griffin Software titles are at W H Smith, Boots, and other computer shops everywhere.



Only £7.99 each to suit the ZX Spectrum 48K Only £9.95 each to suit the BBC Model B.

GRIFFIN SOFTWARE

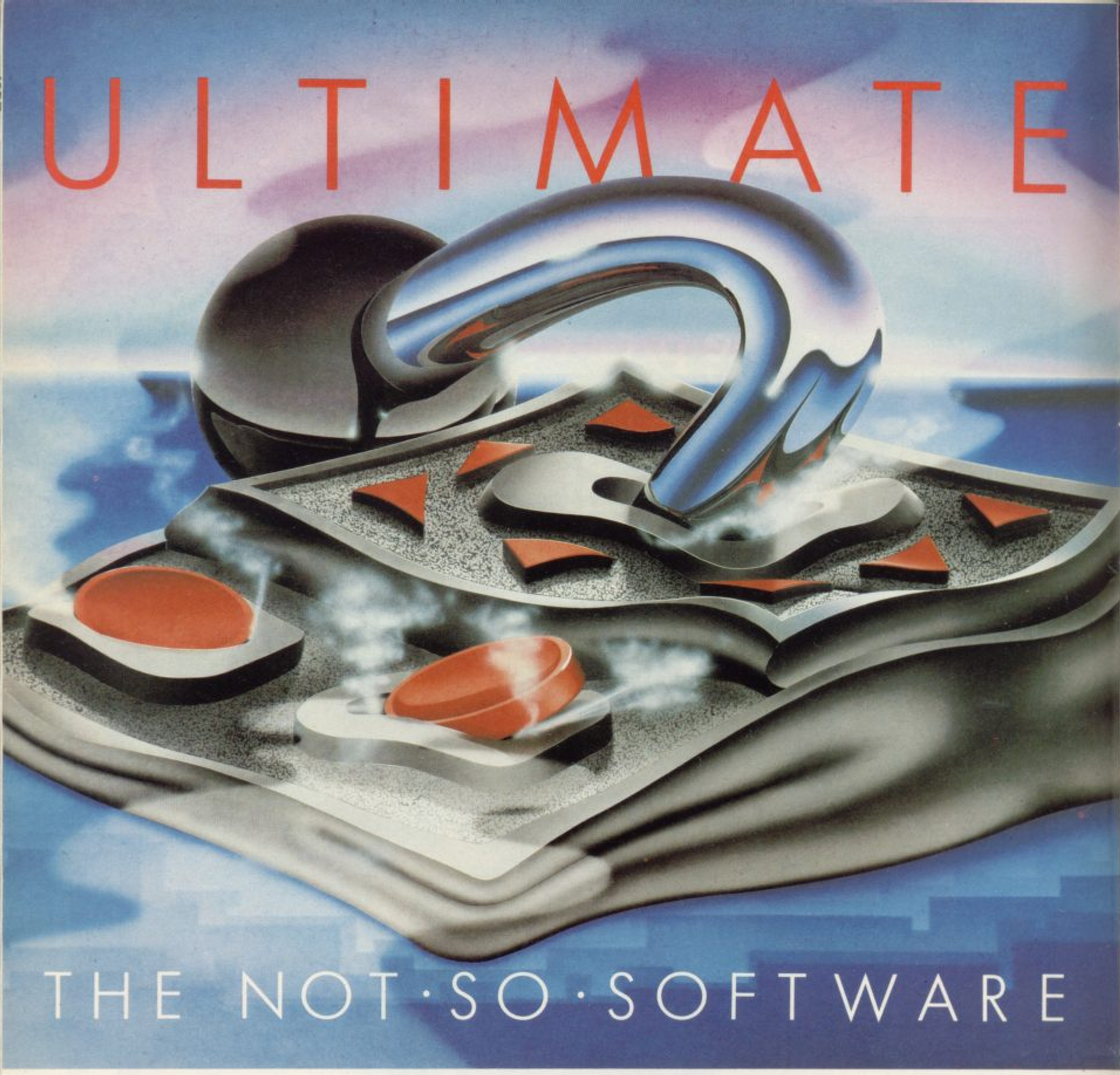
– it's an education.



That's right, even the pirates will be dropping their duplicators to play **Moon Alert**, to join in the swinging fun with **Hunchback**, to attack with **Android Two**, jump for their lives with **Pogo**, spin themselves dizzy with **Chinese Juggler**, they'll just crack-up with **Eskimo Eddie's** Arctic action and there will be no stopping the captain once he gets his hook on **Mr. Wimpy** that zany burger battle.

Even the most rutheless of pirates will be kept busy trying to improve their handicaps on the testing greens of **Royal Birkdale** and if they are still game for action adventure then the **Island of Death** is the place where only the sharpest of swash-bucklers will survive. They'll all be fighting to save the


Even the pirates can't stop playing these priceless new gems from Ocean!
ISLAND OF DEATH
Royal Birkdale
"Championship Golf"
KONG



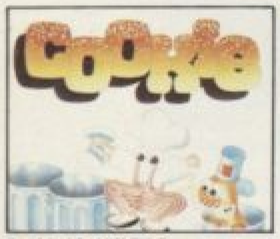
CAN YOU HANDLE THE **ULTIMATE?**

THE MOST AMAZING PROGRAMMES, THE SMOOTHEST ACTION, THE HIGHEST RESOLUTION GRAPHICS?

ALL **ULTIMATE** GAMES ARE ARCADE STANDARD, FEATURE PACKED, 100% MACHINE CODE.

AND PURE ADDICTION.

SO WHICH WILL BLOW FIRST – YOUR COMPUTER OR YOUR MIND?



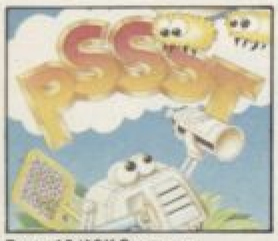
Cookie 16/48K ZX Spectrum



Tranz Am 16/48K ZX Spectrum



Atic Atac 48K ZX Spectrum



Pssst 16/48K Spectrum



Lunar Jetman 48K ZX Spectrum



Jet Pac 16/48K ZX Spectrum or 8K Expanded VIC 20

ONLY £5·50 EACH

(All games joystick or keyboard control)

Available from: W.H. Smith, Boots, John Menzies, Spectrum Centres, large department stores and all good software retailers. Or send the coupon direct. We'll pack and post your order to you absolutely free in the U.K.

Okay, I dare take my computer to the edge of meltdown. Send me the following:

☐ Cookie ☐ Lunar Jetman ☐ Pssst ☐ Tranz Am

☐ Jet Pac ☐ Jet Pac – Expanded VIC 20 ☐ Atic Atac

I enclose cheque/PO for £_____ Name_____

Address_____

Code_____

Send to:
Ultimate Play The Game,
The Green,
Ashby de la Zouch,
Leicestershire.

ULTIMATE PLAY THE GAME

Ultimate Play The Game is a trade name of Ashby Computers and Graphics Ltd., The Green, Ashby de la Zouch, Leicestershire, Tel (0530) 411485. Dealer enquiries welcome.

Improved magazine gets the thumbs-up

CONGRATULATIONS on the recent improvements in *Sinclair User*. The quality of print in the program printouts has been improved and the new system for displaying graphics in the printouts makes life much easier.

There was a mistake in the March issue. In the program Jaws, written for the 48K Spectrum, line 230 should read:

230 IF x1<0 THEN LET x1=30

Such a small error can be solved easily after consulting the *Sinclair User* Starter Pack helping with simple errors.

Soft Centre was also very useful and informative. Well done, and keep up the work to this standard.

Nicholas Wren,
aged 15,
Oxford.

● *Soft Centre will next appear in the June issue of* Sinclair User.

Struggling with Forth

WHAT a very interesting article on Forth was printed in the March issue. I bought Abersoft Forth three or four weeks before I had seen the article. The language seems to be ideal for process control but very weak in other areas.

As I am completely new to Forth I am still struggling, with precious little help from the manuals, to do things which more experienced users find easy. For instance, what is the equivalent of Basic "PRINT AT" or how do you read or write a data line to tape; or, having written a new word into your dictionary, how do you get it out again to change or modify it?

I will be looking forward to new projects with Forth and to attempts to give more attention to serious work on the Spectrum instead of using it as a toy.

Alan Beer,
Baildon,
W Yorks.

● *Many readers have experienced problems with LOADing and SAVEing and John Gilbert will be answering those questions in an article which is at the planning stage. As to the other question, to retrieve a word from a Forth dictionary it is necessary to use a decompiler. Some companies, including East London Robotics, plan to produce one for their products and it is hoped that Melbourne House will issue one in the future.*

Where are the women?

I NOTICE on reading *Sinclair User* every month that there is a distinct lack of female participation in the advertising sections. I am delighted to see that programs written by female users such as myself are included but am surprised to observe the apparent lack of foresight on the part of the advertisers. Surely the female hand looks as attractive as the male on the Spectrum keyboard?

I am convinced that your male readers would not be averse to more female-dominated advertising and, at the same time, such advertising would reassure women that computing is a unisex occupation. **Elizabeth Wilson,**
Oxford.

Watch out for glitches

I WOULD like to say that *Sinclair User* surpasses all other magazines for the Sinclair range of computers. The articles and the information are consistently relevant and of a high standard. *Sinclair User* has greatly enhanced understanding of the new technology. May you continue with this good service for a long time.

On a different note, perhaps I can inform you of some research I have done relating to loading errors. A tape loading error — or a complete failure to 'pick up' the program — will often arise from the recorder volume being too high or from the treble being too high, or both.

Customers often stop the tape when that happens and then rewind to try again. Many recorders cause a glitch on the tape where it was stopped and rewound. When that happens you have lost the program forever. The solution is not to stop and rewind until the tape has reached a blank section. Then lower the volume/treble and try again.

The stop on a program section and rewind glitch accounts for more than 90 percent of returned tapes to software manufacturers. Some tape recorders do it and some do not.

Dr Karl Glasson,
Micro Master,
Chiswick,
London W4.

Egg-ceptional scoring

I ENJOY reading *Sinclair User* very much and I have heard about the defence of Chuckie Egg. I wonder if my score of 210,010 is the highest after going through 20 interesting levels?

Wayne Dennison,
aged 13,
Wakefield.

A change is on the cards

AS THE AUTHOR of Bridge Player for the 48K Spectrum, may I reply to the letter from J W Evans in the February issue in which he comments on the program?

His main criticism is of the arcade-type flashing scores and the jingles. I understand his point but on the other hand most people seem to find those at best amusing and at worst harmless. Contrary to his assumption, they occupy a minimal amount of memory, not sufficient to affect the level of play which, however, by virtue of other changes, is better on the new version of the program to be available soon.

If Evans would like to return his existing tape to me I will not only upgrade it but also, specially for him, remove the arcade games aspects which offend him.

Richard Wheen,
12 Spurfield,
Hurst Park,
East Molesey,
Surrey.

REFERENCE letters in February issue, I endorse the observations of J W Evans regarding the CP Software Bridge Player. Nevertheless, for a serious micro user who does not go for arcade games, the program has given me many hours of pleasure. I do not know how it can be achieved with such sophistication in 48K, despite the crazy opening and responding bids by partner North.

Wheen and Vachha could solve that failing and produce an Improved Bridge Player; I and many other will rush to buy.

R G Miller,
Ipswich.

more letters on page 23



Cracking down on copying

HAUNTED HOUSE, published in March *Sinclair User*, had a line omitted. It should read '6 Return'. In the same program, for any readers wondering what significance the skeleton, ladder and ghost graphics characters beside the score have, they should not be there at all.

The letters AJM are the initials of the original author, Andrew Murgatroyd, from the August, 1983 *Computer and Video Games*, where the program was originally published.

The two programs are identical except for the removal of several AJM lines. I understand that not every entry can be checked for originality but I feel that such an obvious copy as this should have been discovered before printing.

Paul Bamborough,
Newcastle-on-Tyne.

• *It has been brought to our attention by a number of readers that Haunted House was not the original work of the person who submitted the program. Our investigations have confirmed that.*

While we make every effort to ensure that all programs published in Sinclair User *have not been published elsewhere, occasionally one may slip through the net. Fortunately our readers are quick to inform us of any obvious plagiarism.*

We take this opportunity to warn readers that programs which have appeared elsewhere, in book, magazine or cassette form, cannot be considered for inclusion in Sinclair User, *whether or not such programs are the contributor's original work.*

Content is too childish

I BOUGHT my Spectrum last July and shortly afterwards I received an invitation to subscribe to *Sinclair User*.

At the same time I also placed a subscription with another computer magazine and seven issues later the difference between them is marked.

In defence of *Sinclair User* I feel that the comments made regarding the amount of advertisements as being excessive is merely nit-picking and would suggest to the reader concerned that he checks other such magazines; the percentage is about the same in all of them.

With regard to the reader from Perthshire who bewails about difficult competitions, I would suspect that he fails to realise that one has to work at any competition and that prizes are not handed out on a plate. If he was unable to compete in the recent Microdrive competition through lack of knowledge, the answer is develop your knowledge and try again.

I would agree with the reader who says that the level of software in general is poor, though I would go further and say that in particular the so-called arcade games are the biggest rip-off. In all of them the theme is the same — only the locations change.

Thankfully a few software houses are beginning to realise that the variations on the 'shoot-em-up' theme are wearing thin and are starting to produce quality software; it makes a pleasant change to be looked upon as intelligent people and not as gullible idiots.

Finally, may I add my only criticism of *Sinclair User*. In general it is an excellent magazine but obviously aimed at the young and teenage market. One only has to look at the comic illustrations which accompany readers' programs, Sinclair Simon and the proud letters re high scores to realise that perhaps your magazine should have the title Young Sinclair User.

So once my subscription ends I will cheerfully leave your magazine to its intended market. I will miss Andrew Hewson and John Gilbert but the rest of your magazine, for me, leaves much to be desired.

P Gilbert,
Brighton.

• *We have always endeavoured to publish something of interest to every Sinclair user in each issue and consequently some of the content is aimed at younger readers. At the same time there is much which is written with serious applications in mind, such as our recent articles on Forth, our continuing series on machine code, the education section,* Sinclair Business User *and* Hardware World. *Letters, news and Sinclairvoyance are also of relevance to all readers. Obviously we cannot please all users all the time but we feel we succeed in pleasing most of them most of the time.*

Putting the record straight

HAVE I mastered Jet-Pac? If so, is this score a record? My score is 3,152,880, which took me many hours of square-eyed playing. Keep up the standard of a great magazine.

Richard Lee,
aged 12,
Hornchurch,
Essex.

Misleading hardware review

IN THE review of the Kelwood range of Backpacks, I should like to point out that there were inaccuracies and omissions which could give the customer a misleading view of the product.

The review referred to Mullard 'liquorice all-sort capacitors' which were 20 times too big for their job. In fact, the capacitors are not Mullard and to reduce their values by 20 times would certainly lead to high-frequency oscillations and that would be unsatisfactory.

The review failed to mention that the whole range of Backpacks has a housing which is very convenient for carrying the rather weighty Spectrum power pack and, in doing so, tidies the usual mess of wires which is found round the computer. That housing also doubles as a cassette stand for those people who have already found an alternative place for the power pack. Your reviewer is entitled to his opinion but you should make sure of your facts. Surely you are failing in your duty to your readers if you do not give a full and true review of a product in question. Would it not be a good idea to have a readers' panel which could assess new products?

M D Belk,
Kelwood Computer Cases,
Rotherham.

more letters on page 24

All donations gratefully received

ABOUT three months ago I bought a Spectrum. As an experiment one day I took it to work and within a short time queues were forming to use it. What is so unusual about that? The fact is that I am a charge nurse in an acute psychiatric ward for about 20 patients.

The experiment was such a huge success that we have now started a fund to buy a Spectrum and portable TV for the permanent use of the ward. If any readers have unwanted software they would like to donate I and my patients would be most grateful.

Colin Knowles,
314 Birmingham Road,
Lickey End,
Bromsgrove,
Worcs.

I AM INVOLVED with an ILEA Saturday school project in Islington. As part of our activities I run a computer group and although we have access to three Spectrums we desperately need more facilities. There must be a number of people who have discarded their old ZX-80s or ZX-81s, having bought a Spectrum or other micro.

Perhaps some of the people would loan or donate such unused micros, as the funding for the project is minimal. If anyone can help in any way perhaps they would contact me.

Stephen Oxford,
Highbury Fields School,
Highbury Hill, London.

Applying Occam's razor

I HAVE recently been reading some Spectrum books and have seen about three or four complex programs which produce regular Spectrum sound from the keyboard, rather like a small synthesiser.

Those programs were about 100-200 lines long, which was a waste of time, because most of it was printing and telling people that whatever key they pressed they would get a sound from the keyboard and what all the sounds were — middle 'C' or an 'A'; for example. There is a simpler and shorter way of doing it in one line:

```
10 BORDER 0:PAPER
0:INK 0:CLS:PAUSE
0: BEEP
RND/3, RNDx 69: GOTO 10
```

Paul Huggett,
Basildon, Essex.

Cricket captain re-instated

WE SHOULD like to thank you for your review of our product Cricket Captain in the March issue but we would like to point out that the title of the program is Cricket Captain and not County Cricket. You omitted to print our address and as the product is not as yet widely available through retail outlets that will cause some inconvenience to readers who wish to buy the cassette.

Karl Manley,
77 Chorley Road,
Adlington,
Chorley, Lancs.



LOONY ZOO Arcade escape game £5.95 PHARAOH'S TOMB Adventure £4.95 KNIGHT'S QUEST Adventure £5.95
COLDITZ Adventure £6.95 THE FOREST Orienteering simulation £9.95

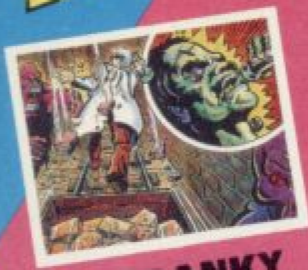
PHIPPS ASSOCIATES

Dept G FREEPOST EM463 (No stamp)
172 Kingston Road, Ewell, Surrey KT19 0BR
Telephone 01-393 0283. 24 Hour answering.

Prices include postage (outside Europe add £1.00 per item). *Access and Visa cards welcome*

Virgin Games

A name to PLAY with



DR FRANKY AND THE MONSTER

By Martin Wheeler for the **Spectrum 48K**

VGC 1011

Battle your way through 9 different dungeons to help Dr Franky revive his monster. Arcade action – action packed!











QUETZALCOATL

By Gareth Briggs for the **Spectrum 48K**

VGC 1007

Trapped in an Aztec temple, your only means of escape is through the passages risking the vengeance of the Aztec Gods.

ATLAS ASSIGNMENT

By Martyn Davies for the **Spectrum 48K**

VGC 1017

This is a text adventure with a difference – it incorporates three arcade-style games, just to keep you on your toes. The player, a secret agent has to seek and find stolen nuclear plans. The fate of the world is in your hands. Using cunning and skill to find the plans, you must decide what objects you find on your journey will be of use to you. Can you enter the world of espionage and survive?

SORCERY

By Martin Wheeler for the **Spectrum 48K**

VGC 1016

By the author of the much acclaimed Dr Franky. In this mystery tale, you are a wizard who can fly, and fly you must, through 15 screens avoiding false trails, evil ghosts and strange beings. You must collect various items and reach the door to the next scene before the attacking beings drain your power. The further you get, the harder it gets and the more compulsive SORCERY becomes. To reach the ultimate goal of your trapped sorcerer friends, you must be fleet of finger and brain. Excellent colour, graphics and sound.



SPECTRON

By Mark Kirkby for the **Spectrum 48K**

VGC 1009

Your only aim in life is to survive! 100% M/CODE, 100% arcade action.



RACING MANAGER

By Mark Alexander for the **Spectrum 48K**

VGC 1005

All the thrills of the racing world.

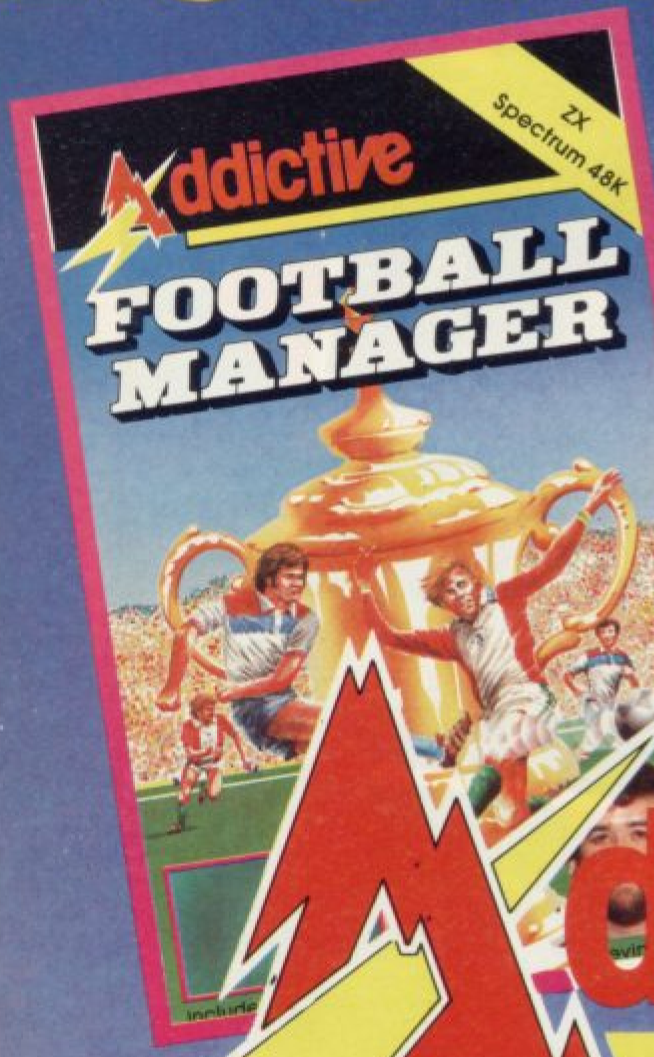
£5.95

GSH Guild of Software Houses

Computer FUN...available NOW!

ZX81 16K, ZX Spectrum 48K

The No. 1 Football Game*



Football Manager

Designed by Kevin Toms

This outstanding game of skill and strategy is now widely available and you can join the many thousands of satisfied customers who have purchased the game. This is no five minute wonder – you will be playing this game for hours over many weeks (we know – our customers tell us!).



Kevin Toms

Some of the features of the game:–

- ★ Matches in 3D graphics
- ★ Transfer market
- ★ Promotion and relegation
- ★ F.A. Cup matches
- ★ Injury problems
- ★ Full league tables
- ★ Four Divisions
- ★ Pick your own team for each match
- ★ As many seasons as you like
- ★ Managerial rating
- ★ 7 skill levels
- ★ Save game facility

Addictive

*ZX81 Chart, Home Computing Weekly 16.8.83

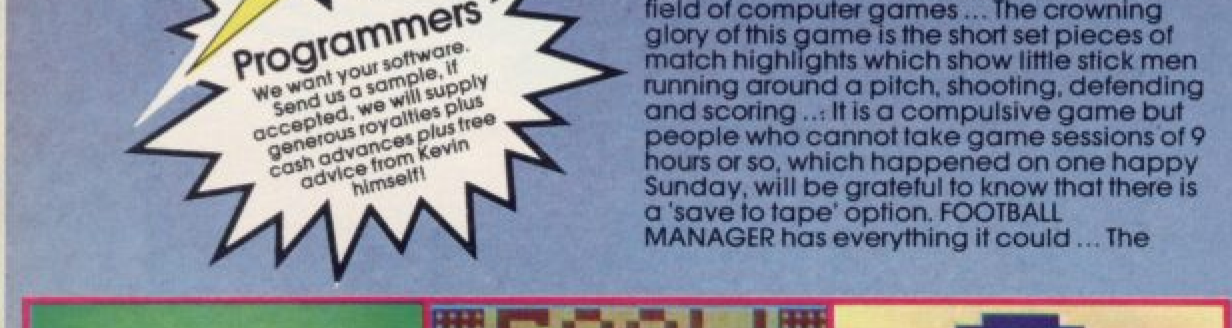
Comments about the game from press and our customers

"FOOTBALL MANAGER is the best game I have yet seen on the Spectrum and my personal favourite of all the games on any micro ... To the ordinary person it is an excellent view of what can be done in the field of computer games ... The crowning glory of this game is the short set pieces of match highlights which show little stick men running around a pitch, shooting, defending and scoring ... It is a compulsive game but people who cannot take game sessions of 9 hours or so, which happened on one happy Sunday, will be grateful to know that there is a 'save to tape' option. FOOTBALL MANAGER has everything it could ... The originator, Addictive Games, certainly deserve the name." Rating: 19/20 (Practical Computing – August 1983).

"When I first received this game I spent the best part of the weekend playing it. Since then I have returned to it more often than any other. The truly addictive quality of this game is the remarkable way it mirrors the real football manager's problems ... "(Personal Computer Games – Summer 1983)

Programmers
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Utility unit from Camel

THE NEW ROM SP from Camel Products is a utility device which allows Spectrum users to retrieve programs stored in EPROMs. Up to 16K of EPROM can be used and there is the option of either having the program load on power up or by pressing a pushbutton.

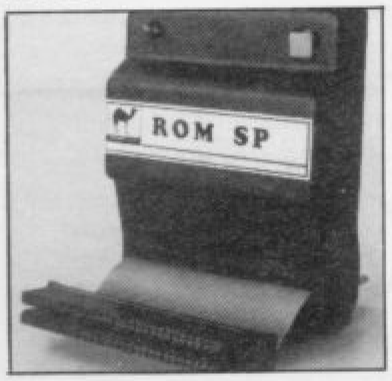
The ROM SP can be used on both Spectrums but the Camel companion EPROM programmer, the PROMER-SP, would be difficult to use on the 16K machine because of lack of memory.

The unit is housed in a custom-designed ABS case and has a flexible connector to the Spectrum user port; on the rear is an extender card for other add-ons. On the top of the case there is a LED, which lights when a program is being transferred, and a push switch.

The unit worked well, the only difficulty being when used on an Issue 1 Spectrum.

For the dedicated EPROM user the unit is essential. Details of the Camel PROMER-SP were not available at the time of writing but a program is apparently provided to allow only essential data to be stored — Basic and/or machine code — to optimise space on the EPROM.

The ROM SP costs £29.95, as does the PROMER-SP, both plus VAT. EPROM erasers are also available from £18.95 plus VAT, all inclusive of p&p. Camel Products is at 1 Milton Road, Cambridge CB4 1UY. Tel: 0223-314814.





Making light work of screen violence

IN THE DIM, dark past when video games consisted of black and white tennis with that distinctive 'boing', there was the then new idea of having a separate gun to fire at the TV screen. The Stack Light Rifle from Stack Computer Services takes the idea a stage further with a four-part sniper's rifle and high-resolution colour. The rifle is supplied with three games on tape, **High Noon, Shooting Gallery** and **Grouse Shoot** for the 48K Spectrum; it is also available for the Commodore 64 and the Vic-20.

The main pistol is attached to 12ft. of cable which ends in a dead-ended ZX-81-size connector which plugs into the Spectrum user port. To the pistol you can attach a barrel, stock and telescopic sight.

Of the three games, High Noon requires the greatest skill. In it a cartoon-style gun fighter will walk across the screen and you have six shots with which to kill him. Of the other games, Grouse Shoot entails shooting at rising birds while in Shooting Gallery you have to shoot a bouncing ball.

The rifle is well-made and surprisingly accurate. It is perhaps regrettable that the present trend towards death and destruction games should result in the appearance of such a device. If, however, that is what you want, then it is, arguably, the best of its type.

The Stack Light Rifle costs £29.95 inc. VAT from the manufacturer, Stack Computer Services, 290-298, Derby Road, Merseyside L20 8LN or local retailers.

Protection gives peace of mind

MICROBYTE has launched a new software protection unit for the Spectrum. It is designed to prevent the computer crashing in the event of either mains noise or a power failure.

The Spectrum power supply is plugged into the unit and a lead is then plugged into the power socket of the Spectrum.

Inside the unit are six AA-type rechargeable batteries and, if there is a power failure, the batteries are kept topped-up and should last for up to 15 minutes. That will give you time to save a program if you have a battery-powered cassette player to hand.

The unit also contains a small circuit to cut mains interference. It is very disconcerting to load a program into the machine, switch it off at the mains and then switch it on again to find that you have not lost the program.

The unit is very easy to use. Once it is plugged in it can be forgotten and yet it gives great peace of mind. Costing £13.95 inc. for either the ZX-81 or Spectrum version, it may well save a good deal of frustration. Microbyte is at 19, Worcester Close, Lichfield, Staffordshire.

Cursor key simulation

WITH ALL Sinclair products any deficiency is soon noted by peripheral makers. Abtron has produced a joystick adaptor lead for people with an Interface 2 which permits a joystick to simulate the cursor keys 5, 6, 7 and 8 and use 0 as fire.

The lead consists of two plugs which plug into the interface and a socket for the joystick. Priced at £7.99 inc. p&p, the lead can be obtained from Abtron, 38 Rydens Avenue, Walton-on-Thames KT12 3JP.

More hardware on page 31

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SU2

Comprehensive graphics aid

THE LAUNCH of the Spectrum heralded an avalanche of graphics pads and software utilities. The Format 4 kit from Orion Software is undoubtedly the most comprehensive and certainly one of the best.

Housed in a smart black ring binder, the kit consists of two main parts. On the rings are 80 sheets of various-sized grids.

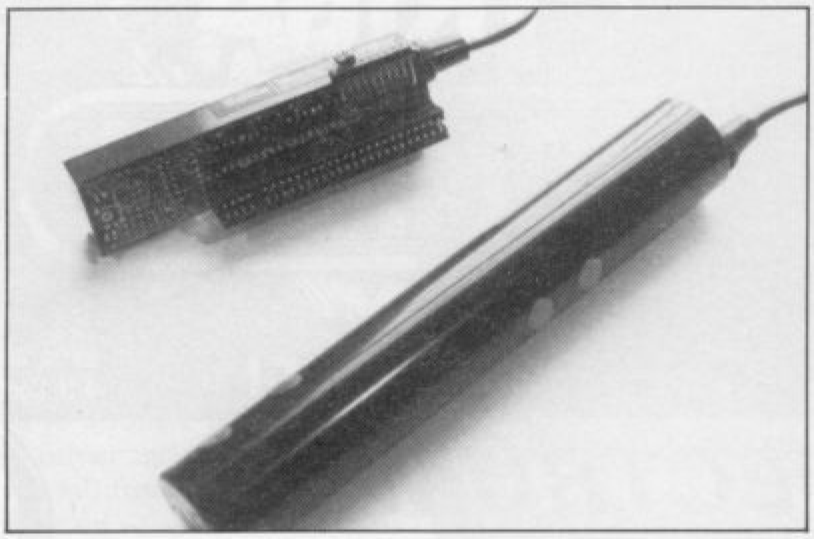
As well as that there is a clear plastic wallet to hold loose pieces of paper, a plastic ruler marked with a pixel scale and a translucent screen for placing over pictures with a full 32×24 grid, each square sub-divided into an 8×8 grid with markings round the sides showing the lines and columns, pixel positions and the memory addresses of each pixel line in hexadecimal.

Inside the front cover are a note pad, seven coloured pens to use on the various sheets, a water-soluble ink pen for use on the translucent screen, a calculator to help calculate the UDGs and a C15 cassette with an optional drawing program.

If you are looking for a serious graphics aid for a Spectrum this kit should be near the top of your list. The only part which is not necessary is the optional program.

The kit costs £16.95 or with the extra program £21.50, plus £2.50 p&p. The cassette is available separately at £6.50. A pack of refill sheets can be obtained for £3.95. If that is too costly, the SP2 kit consisting of translucent screen, pen and wallet is £3.75.

Orion also produces Teleplan, a 32×22 grid on a piece of clear plastic which fixes on to a TV screen and is available for either 14in. or 16in. sets at £1.25 plus 50p p&p. More information from Orion Software Products, Pippbrook Mill, London Road, Dorking, Surrey.



Tricky stick to master

THE LONG-AWAITED Trickstick from East London Robotics has been released. It is a 7in. long black plastic cylinder with six touch-sensitive pads which simulate the four usual joystick movements plus two fire buttons. It is complete with an interface which plugs into the back of the Spectrum. Up to eight can be plugged in at any time and there is an option to give proportional movement on specially-written games. Normally it simulates the Kempston joystick, so there are many games readily available on which it can be used.

The touch pads are drawing pins which use your body as an aerial to pick up mains hum. That is converted by the electronics to simulate the keypress. As some people are better 'aerials' than others, the sensitivity of the stick can be altered by a small screw near the top.

The stick was tried on a number of games, including the trainer tape supplied, and worked well. It takes some time to get used to it, unlike a joystick but, once mastered, was just as useful. The only difficulty is that you need two hands to use it, so for games where you have to use the keyboard as well as a joystick, you have to keep removing one hand.

If you are looking for a joystick, the Trickstick is worth considering. As it has no moving parts it should withstand a good deal of use and, provided you can spend time getting used to it, it is quicker than most joysticks.

Trickstick is available by mail order for £34.50 from East London Robotics Ltd, Gate 11, Royal Albert Dock, London E16.

Ideal home disc drive

IN RECENT months there have been a number of disc systems appearing for the Spectrum, not to mention the Microdrive. One of the first was the Viscount system from Interactive Instruments.

The system comprises an interface which plugs into the back of a 48K Spectrum and a 5¼in. Shugart disc drive, complete with connecting cable. Interactive can supply an extension cable if necessary if you want to add a printer interface, for example. Also the interface will support only one drive and that has only single-sided discs but it manages to squeeze more than 107K on to them.

Setting up the system is very straightforward. On power-up the contents of the EPROM is loaded into the upper 8K of memory and a number of extra variables are added; they occupy another 110 bytes. Those variables are used to call the various functions of the interface.

The first step is to format a new disc, which is done by entering the command PRINT USR nd. Once formatted the disc will have 40 tracks, each 2,816 bytes long. The first track is always taken up with the directory, so you are left with 39 tracks, a total of 109,824 bytes of storage.

Both Basic and machine code can be made to auto-run; code can also be made to load into a different area from the one from which it was saved. The way of filing f$ for arrays is a little complicated and arrays also have one major disadvantage.

Each time an array is saved you are limited to a length of 2,816 bytes, so if you were using a program which uses a string of 28,000 characters you would have to save it in pieces.

In use, the system is at least twice as fast as a Microdrive but the penalty is that it uses a good deal of RAM space.

That means that although it is ideal for business you cannot use programs such as Tasword or Masterfile on it. Transform Ltd, however, can supply some of its software on disc.

Overall, the system is ideal for home users who write their own programs or as part of a development system. The system can be obtained from the Spectrum chain of shops, costing £245 inc. or from the manufacturer, Interactive Instruments, Ltd, Unit 6, Pilot House, King Street, Leicester.

Keeping the balls rolling



THE LATEST sequel to Pi-mania, Pi-Eyed and other Automata productions is **Pi-Balled.** Starring the Pi-man again, the story involves the mystical pyramid of Pi, the colour of which you are attempting to change by jumping from square to square while avoiding collision with two bouncing balls, Sid the Snake, the Pi-man and other hazards.

In spite of the zany presentation which has become the Automata hallmark, including a title screen crammed with grotesque leering characters, Pi-Balled is a fairly straightforward arcade game. You score points by jumping on to a square and changing its colour and you lose a life if you fall from the edge of the pyramid — which is easy to do until you become accustomed to the unusual diagonal movements required by the game — or if you land on the same square as one of the other characters. There are bonus points for every pyramid you complete and new hazards to make successive screens more difficult.

Among the original features which add appeal is a spinning disc which carries you aloft gracefully, a free ride allowed once each screen. Beware, however, of the balls which materialise at the top of the pyramid; if you choose to transfer from your disc at the time they are doing so, you will lose a life.

Pi-Balled has lively graphics — the representation of the bouncing balls is particularly convincing — and the degree of difficulty is well-judged to please both novices and more experienced players. A pop record on side two is a doubtful bonus.

PI-BALLED
Memory: **48K**
Price: **£6.00**
Joystick: **Kempston**
Gilbert Factor: **7**

Minter quality

SOFTWARE written for other machines usually loses some of its essence in translation to another machine. That is not true, however, of **Laser Zone** for the Spectrum. It is by Jeff Minter and was written originally for the Commodore machines.

The game revolves around a grid, called a zone, on which are mounted two laser turrets — one on the X axis and one on the Y. They can be used by one or two players to kill the exotic aliens which stream across from the left-hand side of the screen.

The laser turrets are powerful but on the higher skill levels you must watch for random laser bolts which flash across the screen.

The game is enjoyable and extremely addictive. The graphics may not be so good as on the more powerful machines which support sprites, but it is essential for any arcade fan who wants something different to fire at for a change.

LASER ZONE
Memory: **48K**
Price: **£6.95**
Joystick: **Interface Two, Kempston**
Gilbert Factor: **8**

Indefensible Defenda

DEFENDA, for the Spectrum, is hardly earth-shaking and it would barely register on the Richter scale of software, as it is yet another version of the well-worn arcade favourite Defender.

Interstella, the company which manufactures the game, may be new to the software scene and the Spectrum but that is no excuse for producing a game which appears outdated and uninventive.

You will experience a sudden attack of *déjà vu* as your ship appears above an alien landscape. It can move in all directions on the screen. As it moves horizontally the landscape below it scrolls across the screen and the aliens materialise, ready to kill or be killed.



As in the arcade version, the alien ships have a habit of picking up refugees who are on the ground. If you shoot an alien which is carrying a refugee the little figure will fall to the ground and die. It is also your job to rescue refugees who look as though they may meet with a sticky end.

The game is joystick-compatible but it is scarcely worth using such an aid as the keyboard is ample for earning points. Neither is it worth moving through to the depths of skill in the game as the graphics do not become any more than ordinary. It can be obtained from Interstella Software, 82 New Forest Drive, Brockenhurst.

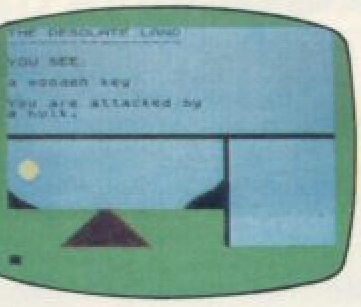
DEFENDA
Memory: **48K**
Price: **£5.50**
Joystick: **Interface Two, Kempston**
Gilbert Factor: **2**

Games for girls—slow, simple and patronising

THE FIRST THREE in a series of **Games for Girls** promised by CCS do not augur well for the rest of the line. Apart from a tenuous link with show jumping in one game, and a heroine rather than a hero in another, it is difficult to see where the special appeal for the female half of the cassette-buying public lies, unless simplicity and slowness are intended to be the main selling-point.

The intentions of CCS in producing the series may have been well-meaning but the overall quality of the games and the patronising tone of the inserts could lay the company open to charges of sexism.

Hicksted is designed as a simulation of a show jumping event but neither the graphics nor the laborious question-and-answer process which has to take place before the game can start convey any sense of excitement. The control keys are placed awkwardly and a great deal of practice is needed before the path of the horse loses its resemblance to a bull on the rampage rather than a well-trained steed.



The second side of the tape offers a mathematical version which is a good deal more entertaining than the original, since the primitive graphics and movement do not matter so much. The object is to take the jumps by answering mathematics questions correctly; you can choose to be tested on multiplication, division, addition and subtraction, with several levels of difficulty for each. A time factor adds a challenge and the game provides an effective form of maths drill.

The insert for **Diamond Quest** makes the dubious claim that the colourful graphics and absence of monsters make it specially suitable for girls. In fact it is a straightforward graphics adventure, in which the object is to collect four keys and find your way to a Golden Palace where a treasure is to be found. On your way you encounter unpleasant creatures such as a hulk, some bloodthirsty bats, wild lions and swarming mosquitoes, and you can replenish your strength by eating food or booking into a hotel.

The game features simple one-character commands, a variety of locations which have little to distinguish them from each other apart from their names, and a series of battles which take the form of your enemy's energy level and your own ticking away numerically before your eyes.

There are several levels of difficulty and if you have never played an adventure game previously, the ease of movement from one scenario to another might prove an attractive introduction to the genre.

In other respects the game does not have the sophistication or mind-taxing qualities of many other adventures on the market.

Jungle Adventure features Bobo, a young African girl making her way from school to her home in the jungle. The game starts at school, where Bobo must try to win prizes such as an egg, a hamburger, a coconut or a book with which she will later bribe the creatures she meets in the jungle. The prizes are won by a Mastermind-style guessing game which, although scarcely original, is entertaining.

The second stage of the game, in which Bobo must make her way past a variety of creatures which become visible only when she bumps into them, is less successful, especially as the placing of the keys makes it extremely difficult to complete the journey. An unfortunate slip by which Bobo is referred to as he rather than she when she falls into the lake is in this context a serious fault.

HICKSTED/MATHSTED
Memory: **48K**
Price: **£5**
Joystick: **Kempston**
Gilbert Factor: **5**

DIAMOND QUEST
Memory: **48K**
Price: **£5**
Gilbert Factor: **4**

JUNGLE ADVENTURE
Memory: **48K**
Price: **£6**
Gilbert Factor: **4**





Greased lightning

YOUR HELICOPTER is poised on the deck of a battleship ready to take off and destroy the nuclear reactor which is endangering life in **Blue Thunder** for the 48K Spectrum.

You must fly your whirlybird through enemy terrain, attacked by the gun installations on land and sea. Once through that murderous onslaught you have to gain access to the nuclear reactor which is beneath the waves and fire your guns to make it explode. If you are not quick enough you will be destroyed.

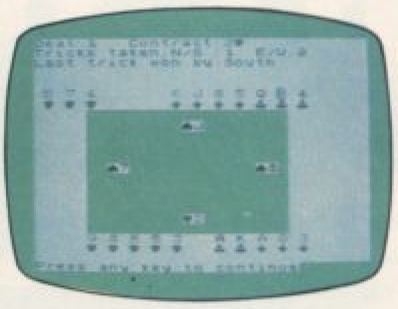
The game has a simple appearance but the animated graphics are well-produced and are a major selling-point. The detail is so complete that the helicopter rotor blades seem to increase speed when it is stationary, hovering opposite a target.

The only difficulty a player could experience is completing one mission, let alone several. Your small ammunition, which looks like full stops coming from the helicopter, makes it difficult to judge whether you will hit anything or not.

Blue Thunder is original and entertaining. It can be obtained from Richard Wilcox Software, Foundary Business Systems Ltd, 2 Station Road, Walsall, West Midlands WS7 0JZ.

BLUE THUNDER
Memory: **48K**
Price: **£5.95**
Joystick: **Kempston**
Gilbert Factor: **6**

Bridge that gap and make that contract



IF YOU are an avid bridge player you will know that it is often very difficult to find three other people to play what is perhaps the most exciting and complex of card games. Unless you go to classes it is also difficult to have the opportunity to learn more advanced play without upsetting expert partners or losing a little cash.

CP Software has come to the rescue with two programs designed to meet the problems — **Bridge Player** and **Bridge Tutor — Advanced.**

Both programs use the Acol bidding system and accept most conventional bids, including the Stayman and Blackwood conventions. Full cassette notes supplement the programs and give comprehensive instructions on the playing method.

In Bridge Player it is assumed that you have some idea of the basics of bridge playing. The computer will shuffle and deal a new random hand each time and you can then elect either to bid your hand in the normal way, following it with the game, or you can choose to see all four hands, decide the contract and declarer, and then play out the contract. When the play is completed, the score is displayed with details of vulnerability. If you did not make the contract, the program even plays the *Dead March* in sympathy. You can review and replay the hand if you wish, though a replayed hand will not count towards your score.

Each hand can be printed-out if you have a printer and general operating procedure is very simple, enabling you to get straight into the play. Remember, every hand is new, so you can go back to Bridge Player time after time.

Bridge Tutor — Advanced offers 40 pre-dealt hands for the more competent player. Each hand must be loaded separately after you have loaded the main program, so do not forget to follow the instructions on-screen — the prompts are very helpful.

The play is similar and will allow only the recommended card to be put down. After the hand has been played, there is a very full explanation of the bidding and play it was designed to illustrate. You may go direct to the explanation at any time or replay the hand.

Both programs are well-designed, with clear graphics using a green table. They are of a high quality and will be of great use to players who want to improve their game.

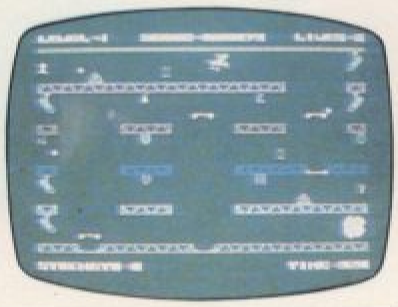
BRIDGE PLAYER
Memory: **48K**
Price: **£8.95**
Gilbert Factor: **8**

BRIDGE TUTOR (ADVANCED)
Memory: **16K**
Price: **£5.95**
Gilbert Factor: **8**

Ten years behind the times

ACCORDING to Smiffy, a character in **1994,** a new game for the Spectrum, George Orwell chose correctly with his Big Brother theory but had the year wrong — it should have been 1994.

Apart from that there is nothing remotely interesting or startling in the game. It looks as if manufacturer Visions has jumped on the Manic Miner bandwagon. Smiffy has to climb a structure of platforms which are being bombarded continually by alien creatures. He has to climb through the nightmare world and attack the central computer which, in the best Tronic traditions, is holding the world in its metallic grasp. Switching off the computer will win the game.



The screen is filled with a series of exotic blips and blobs which could be anything. If the scenario is a nightmare, the instructions are worse, as you have to grope round the keyboard to find which keys to press.

The high score table and paragraph giving details of the game may be futuristic in style but they are also illegible. The 'computer-style' characters are too heavy and it is difficult to distinguish between numbers and characters on the high score table.

There is nothing to distinguish the program from any of the others which resemble Manic Miner. If you are new to computers, however, and have not seen Manic Miner you may like 1994.

The game is produced by Visions, 1 Felgate Mews, Studland Street, London W6 9JT.

1994
Memory: **48K**
Price: **£9.95**
Joystick:
Gilbert Factor: **4**

Better than the average

THE CRICKET season has begun so it is a good idea to have a program which will keep track of players' averages.

Cricket Averages for the 48K Spectrum will keep track of all the details you will need to keep up-to-date with your home team and if you are managing a local club you will be able to organise play round the results produced by the program.

Names of players, batting and bowling must first be entered and that can then be sorted by the computer into alphabetical and numerical order. That will take about two minutes, which is extremely slow for the amount of data which you can include in the program.

You will then have a list of players and their averages which you can store on tape. Once you have created a file, amending it is easy. All you have to do is push the correct menu option and the computer will prompt you for the information which is necessary.

Once you have entered the data you will be able to look at individual player records, bowling averages and catches taken. The batting averages of each player or all the team can also be accessed.

For the cricket enthusiast the tape will prove invaluable. More details of Cricket Averages can be obtained from Spartan CC, 29 Feltham Ave, East Moseley, Surrey KT8 9BJ.

CRICKET AVERAGES
Memory: **48K**
Gilbert Factor: **7**

It's no picnic!

But if you go down to the woods today, will you help Ted get his batteries?

Or will you get bovvered?

Or get the cocktail?

Will you ever reach the 8th round?



Come to that, will you ever work out the scoring system?

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Blast from the past

We continue our look back at classic ZX-81 programs

IF YOU own a new ZX-81 and are wondering what you can do with it, Carnell Software might have the answer, a **ZX Compendium** of games ranging from the traditional to the completely alien. The two-cassette package contains six programs, two of which are adventures. The first, **Alien Intruder,** displays graphically the advance of the spaceman-eating life-form through the various levels of your starship as you load supplies frantically on to the shuttle craft which is your only means of escape.

In **Wumpus Adventure** you track the fearsome and smelly Wumpus through a maze of caverns, swamps and pits. The game can be played by one to four players.

The other programs on the cassettes are **Numerology, Movie Mogul, Hieroglyphics** and the ubiquitous **Hangman.** Of those, Hieroglyphics is the most interesting, a word game depicting a hieroglyphic message which must be deciphered before the intrepid explorer, Wullie Makeit, is buried alive.

Another version of Hangman, gruesomely titled **Lynchmob,** is produced by Bridge Software and provides a graphic animated hanging sequence. The game can be played by up to six people while the computer acts as referee. Bridge Software still produces a number of 16K and 1K cassettes and one of the most popular is **Ephemeris,** an astrology program which provides comprehensive information on the sun, moon and planets, including local sidereal times, rising and setting times, distances from Earth and much more. There is a COPY option for the ZX printer, a necessity for astrologers. Bridge Software can be contacted at 36 Fernwood, Marple Bridge, Stockport, Cheshire, SK6 5BE.

CCS has quietly been producing excellent strategy games for some time. Two of the earlier ones for the 16K ZX-81 are **Airline** and **Autochef.** In the former the aim is to take over British Airways—if the Government has not sold it in the meantime—while coping with a series of hazards such as staff disputes and PLO hijackings.

Autochef simulates the business of managing a chain of fast food outlets and in the limited time available you must increase your £1 million pound capital to £25 million, overcoming setbacks and dealing with annual inflation.

The distinctions between adventure, strategy and simulation games are often vague and open to publishers' interpretations. Occasionally software falls into all three categories. That is true of both **Pioneer Trail** and **Ocean Trader** from Quicksilva, though both are advertised as adventure games.

In Pioneer Trail you set out with your family to conquer the untamed west in a covered wagon drawn by two decrepit horses, and with only $700 with which to buy supplies. The program combines adventure and arcade graphics and the hazards to be faced range from patchy fog to Apache indians.

Contemporary with that is Ocean Trader, set on the high seas in the 19th century and featuring pirates, sea mists and freak storms.

An interesting development in software is that of computer-moderated board games and it is surprising that few publishers have recognised the potential in that market. Martech has produced **Galaxy Conflict** for the 16K ZX-81, which comprises game board, counters, markers and program. The two players build and maintain battle fleets of Eon-cruisers and fight for the supremacy of the galaxy.

Galaxy Conflict can be obtained from Martech Games, 9 Dillingburgh Road, Eastbourne, Sussex BN20 8LY. Another war strategy game, **Conflict,** is also available.

ZX-COMPENDIUM
Memory: **16K**
Price: **£6.90**
Gilbert Factor: **7**

LYNCHMOB
Memory: **16K**
Price: **£4.95**
Gilbert Factor: **6**

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Memory: **16K**
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Gilbert Factor: **7**

AIRLINE
Memory: **16K**
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Gilbert Factor: **7**

AUTOCHEF
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Price: **£5**
Gilbert Factor: **7**

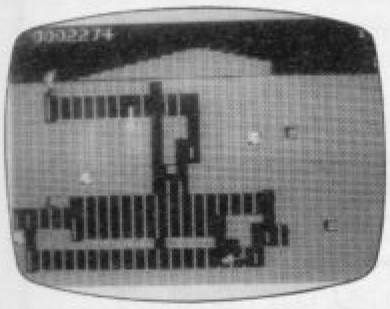
PIONEER TRAIL
Memory: **16K**
Price: **£3.95**
Gilbert Factor: **7**

OCEAN TRADER
Memory: **16K**
Price: **£3.95**
Gilbert Factor: **7**

GALAXY CONFLICT
Memory: **16K**
Price: **£11.95**
Gilbert Factor: **8**

Underground movements

NEW ZX-81 software is difficult to obtain nowadays but Software Farm has released the first in its high-res range of games for the ZX-81. The graphics in the game, entitled **Forty Niner,** are impressive, depicting a tunneling miner as he digs in search of golden nuggets, avoiding the giant rats which burrow towards him.



Knocking over the pit-props delays the rats by causing a cave-in but to destroy them you need to release the snakes from their nests. If you succeed in locating all the nuggets you pass to the next, more dangerous, stage by passing through the cave entrance in the bottom right of the screen.

As if all that frantic subterranean activity was not sufficient, above ground a misshapen one-legged gremlin is hopping around and chomping through your waste earth pile, seeking the entrance to the mineshaft to cut off your only means of escape. You can prevent that only by sending the miner back to the surface periodically to replenish the mound of earth.

An attractive and addictive game, Forty Niner is one of the best graphic arcade adventures for the expanded ZX-81. It is available from Software Farm, 155 Whiteladies Road, Clifton, Bristol BS8 2RG.

FORTY NINER
Memory: **16K**
Price: **£5.95**
Gilbert Factor: **9**

Nicole Segre zooms in on flight programmer Gibson

Reach for the sky

LESS THAN two years ago, John Gibson was living on a remote mountainside in Wales and making a precarious living by installing suspended ceilings. Today he is a mainstay of the Imagine Software team of programmers in Liverpool, author of three best-selling games for the Spectrum, and the proud owner of a metallic brown Porsche 924. "I can't believe my luck," he says, "especially at my age."

At 36, Gibson is the oldest of the Imagine Software team, whose average age is somewhere around 19. Age, however, has not prevented any of his games figuring in the charts within a short time of their release.

The first was **Molar Maul,** which was set, of all places, in a mouth where evil bacteria such as the green meanies and the DKs must be warded-off by means of weapons like toothbrush and toothpaste. "It sold well in spite of being in rather poor taste," says Gibson. His next game, **Zzoom,** was more in the classic mould of arcade games, except that it had a scrolling screen, then a novel feature, and that the enemy craft to be shot from the sky headed straight towards the player.

Gibson's present hit is **Stonkers,** a complex strategic war game which makes a complete break from previous Imagine Software games. Stonkers features a battle zone — "nowhere in particular but it resembles the northern coast of Europe," says Gibson — complete with marshland, river, mountains and open country.

The player's army is ranged against that of the computer and must try to over-run its supply point and military HQ to win the war. The ordinary screen display shows the battle terrain, with panels at the sides and bottom keeping the player informed constantly as to the relative strength of the two armies and individual units. At regular intervals, ticker tape messages run across the bottom of the map with the latest battle updates.

The truly original feature of the game is the way in which pressing the fire button permits the player to zoom in on any particular segment of the map, which is then displayed in fine detail, complete with whatever artillery units, tanks or supply ships happen to be in it.

Within the limits imposed by the Spectrum memory, the game also incorporates artificial intelligence techniques, with the computer making rational decisions based on the player's moves. "A fair degree of strategic planning is needed all the way through," says Gibson.

Stonkers represents a considerable programming feat, which is all the more surprising because Gibson entered the field comparatively recently and via a roundabout route. Born and raised at Mitcham, south London, he studied polymer engineering at Manchester University and then applied for a post as a trainee computer programmer with a multi-national plastics company. A promising career was nipped in the bud, however, when the company decided to cancel the scheme four weeks before Gibson was due to start, sending him on his way with a month's salary.

Gibson drove a wholesale chemist's van for a time before deciding to settle for something sedentary and enter the services of the Department of Health and Social Security, where he was to remain for the next eight years.

> 'Stonkers represents a considerable programming feat, which is all the more surprising because Gibson entered the field comparatively recently via a roundabout route'

"I was always bored with the job," he says, "but one way of relieving boredom was to ask to be posted to various parts of the country." As a result, he worked in social security offices in Manchester, Cornwall and Wales, before he finally exchanged the uncongenial task of visiting people to assess their eligibility for supplementary benefit for that of erecting suspended ceilings on a self-employed basis.

Seeing no glittering future in that career either, Gibson joined a TOPS computing course in Liverpool. "The course involved programming an IBM 43/41 in RPG II, which normally should have led to processing business data for a large company rather than working for Imagine Software," says Gibson, "but it also happened to put me in the right place at the right time."

Through the TOPS course, Gibson heard that Mark Butler and Dave Lawson, who had recently set up Imagine Software, were looking for machine code programmers. Although his course did not qualify him for the job, Gibson had taught himself machine code on a ZX-81 he bought in 1980. "I could not afford a 16K RAM pack in those days and with only 1K to play with, there was no choice but to learn machine code," he says.

Called for interview, Gibson was asked if he could produce a fully-fledged game for the Spectrum in the next month. "I did not know what to say," he recalls. "I had no idea whether I could do it or not." After some hesitation, he decided it was worth trying and set to work on Molar Maul, an idea which had grown out of the dental treatment both Butler and Lawson were receiving at the time. The game did well and Gibson has never looked back.

Since he joined Imagine Software at the beginning of 1983, Gibson has seen the company grow beyond his wildest predictions. From the original team of six, including himself and the celebrated Eugene Evans, it now employs 100 people, of whom 28 are full-time programmers, and has spread to three sleek buildings in the centre of Liverpool.

Fast cars are almost a company trademark and a fleet of Ferraris, Porsches and Lotuses indicates the presence of top Imagine programmers or directors. Gibson's Porsche was a bonus for completing Stonkers in a gruelling two months.

Imagine Software also boasts art and music departments to help with the graphics and sound of its programs. "It's very pleasant," says Gibson. "I had only to produce the code for Stonkers instead of doing everything myself, as I used to do."

The idea for Stonkers came from Lawson, who suggested it on the grounds that Imagine had never produced a war game. The emphasis was to be on graphics and real-time action, to distinguish the game from simpler ver-

sions produced by other companies. Gibson's research on the project was limited.

"I based it on TV and film documentaries, some war games magazines lent to me by a fellow programmer who is interested in those things, and plain common sense. The complexity of the strategy was in any case restricted to what I could fit into the computer memory," he says.

Gibson wrote the program on a company Sage IV, which has 1MB of memory. "It was wonderful to be able to store everything on one disc, rather than many different ones on which people made their jam sandwiches," he says. Before the Sage IV, he was using an Apple 256K and says he has never programmed directly on the Spectrum.

To plot the map for Stonkers, Gibson and Imagine artist Paul Lindale used a sheet of graph paper, or rather several stuck together, measuring 13ft. by 8ft. The graphics for the map and its large-scale segments took up 21K of memory and Gibson used every available remaining byte, plus a few more which he was able to squeeze from the machine by juggling with sections of the program, for the strategy and action. "That is why the game has no catchy tunes or fancy title screen. There simply was no room."

Gibson says he would have enjoyed writing Stonkers for the QL which would have allowed a more complex game than is possible for the Spectrum. He foresees a spate of games for the QL as soon as it becomes readily available.

"Certainly Imagine would have no difficulty in adapting to the QL, although I do not think we or other companies would cease to produce Spectrum games. The Spectrum is still the chief money-spinner for software houses."

With another programmer, Ian Wetherby, Gibson is working on a new Spectrum game, **Bandersnatch,** which is due to appear at the end of May. It is already being billed as a "megagame" and Gibson will say no more about it than that it will be several types of game rolled into one and that "it will look and sound fantastic."

In spite of the many changes at Imagine Software in the short time Gibson has worked there, he still finds it provides "a great working environment. I am working with friends and being paid for something I am good at and enjoy doing. I also feel fortunate at my age to be at the start of something so new and exciting." A prey to constant jokes on the subject of his advanced years and decrepitude, Gibson explains the fact that most programmers are so much younger than himself by saying:

"They are the ones who like playing the games, so it is natural for them to be involved in writing them." He claims that he has no aptitude for playing computer games — "a 17-year-old like Eugene Evans can play the games I have written better than I can," he says. He attributes his programming skill to sheer patience and persistence.

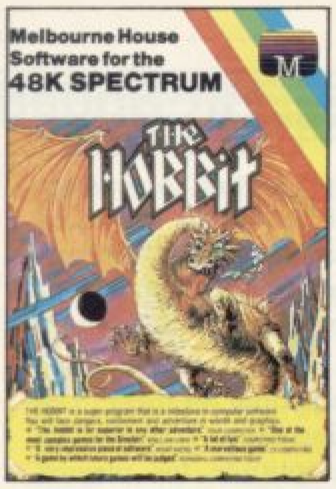
Although Gibson thinks the games boom is bound to level-out in time, he sees no end to it in the near future. He also thinks that computers like the QL will become part of people's homes — not just for filing, word processing, accounting and the like, but for things like controlling lights, television sets and central heating.

Gibson frequently works late into the night, sometimes for days at a stretch where there is a deadline to be met, so that he has little time for outside interests, but he likes marquetry.

He recalls that while still at school he played with a rock group called Mud. He left the group to go to college, while they made a series of hits. "I often wondered whether I had done the right thing but it all seems to have come out right in the end," he says. "My mother would say it was fate. Perhaps she is right."



Gibson on the look-out for software bandits at 12 o'clock high?



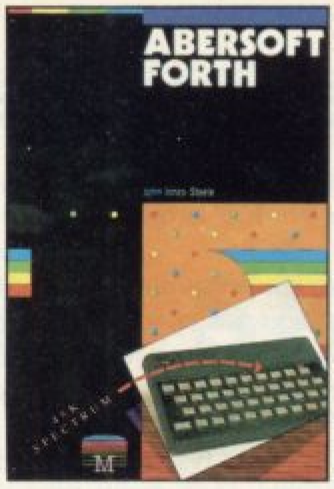
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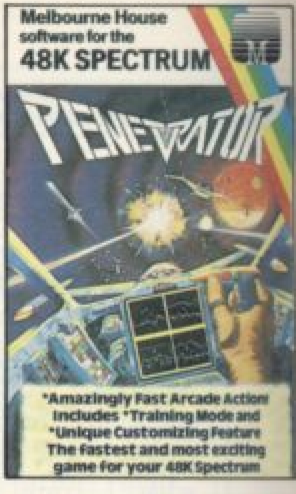
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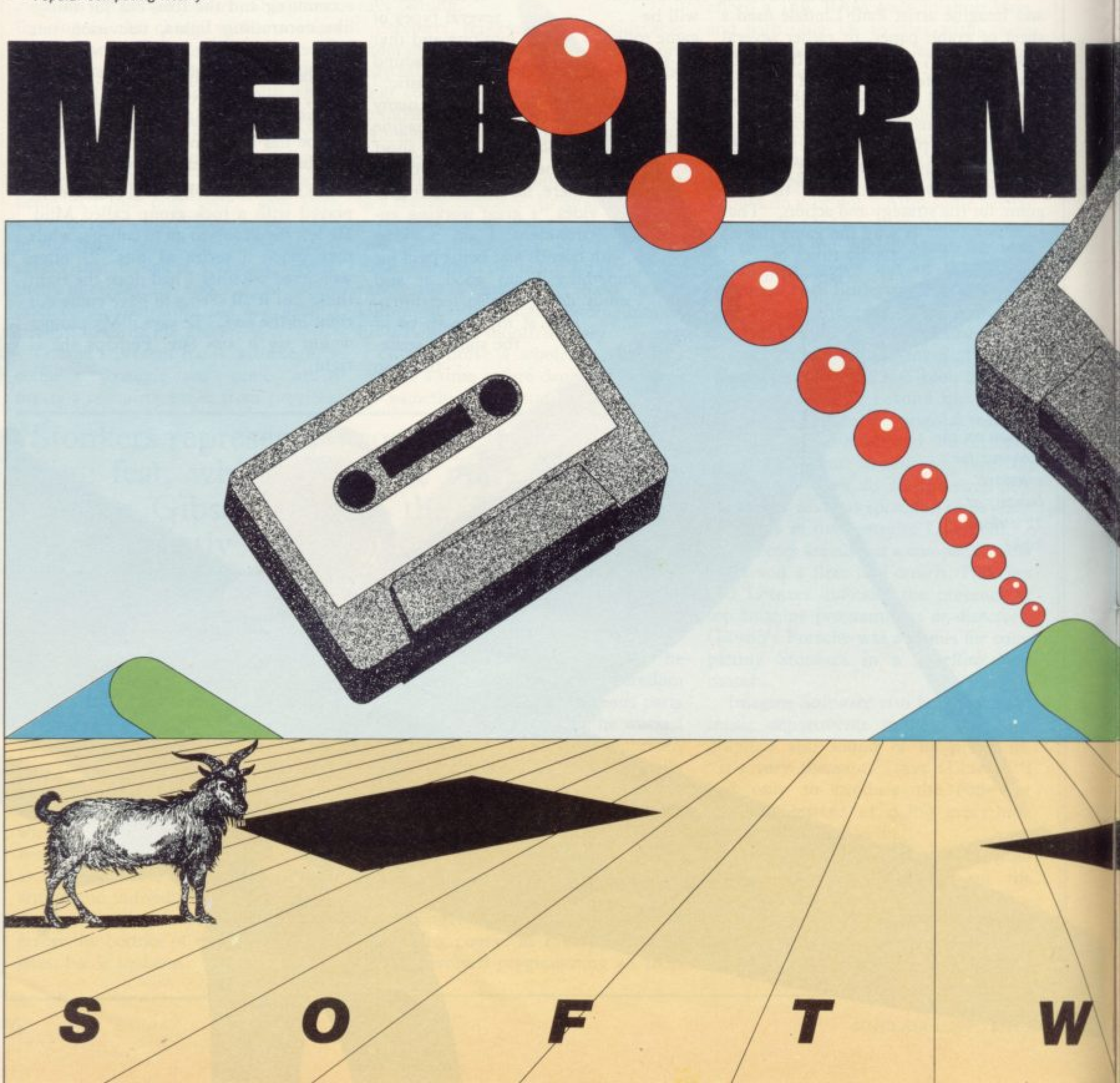
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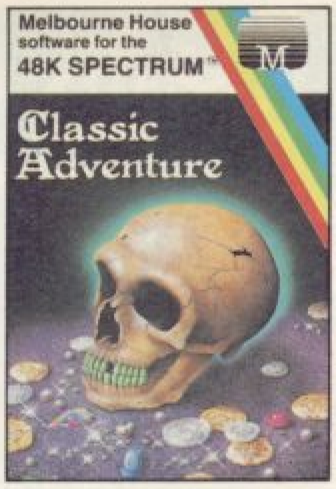


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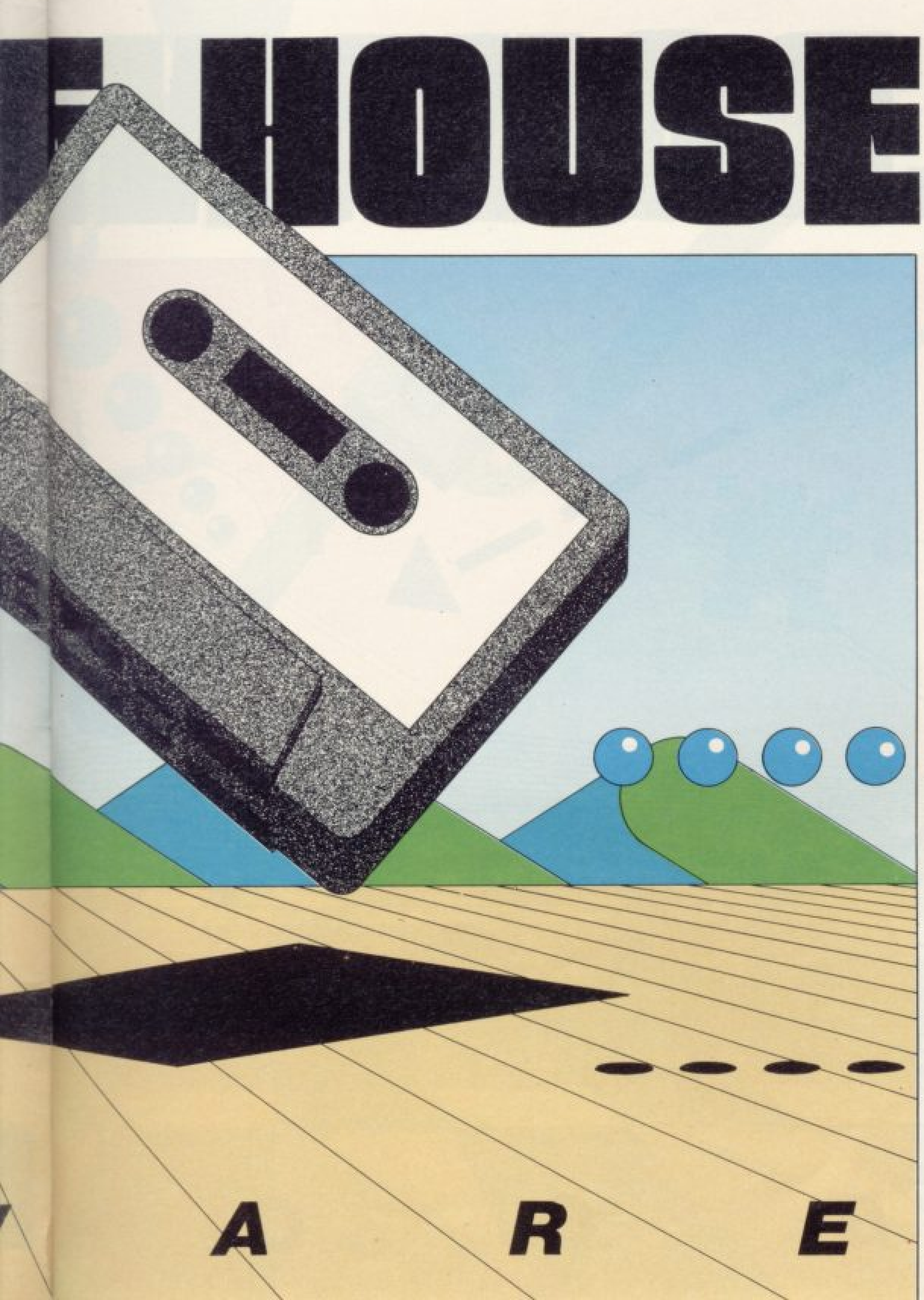
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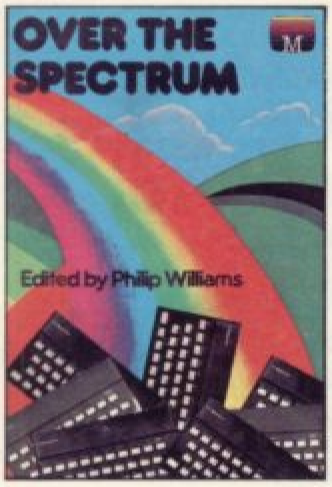
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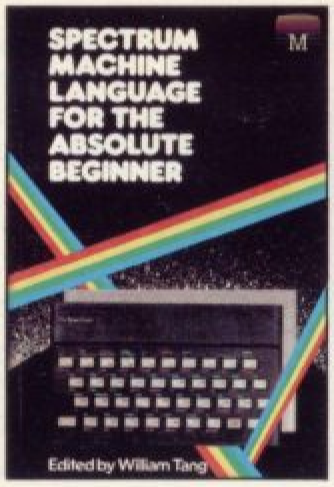
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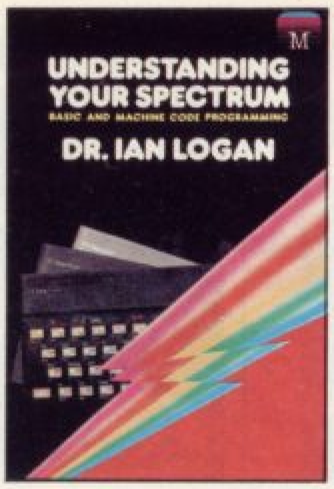
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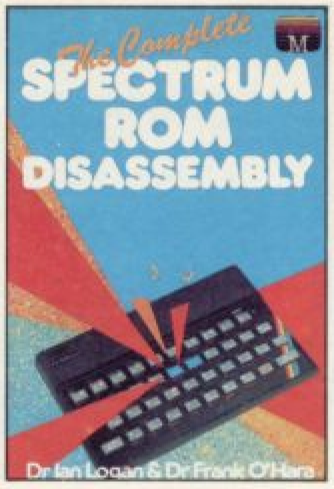
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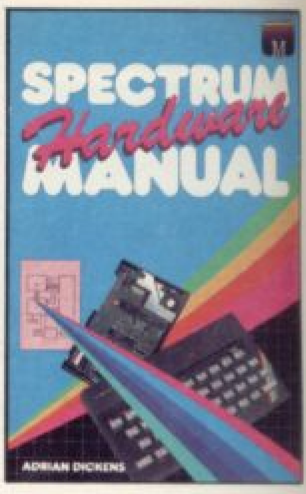
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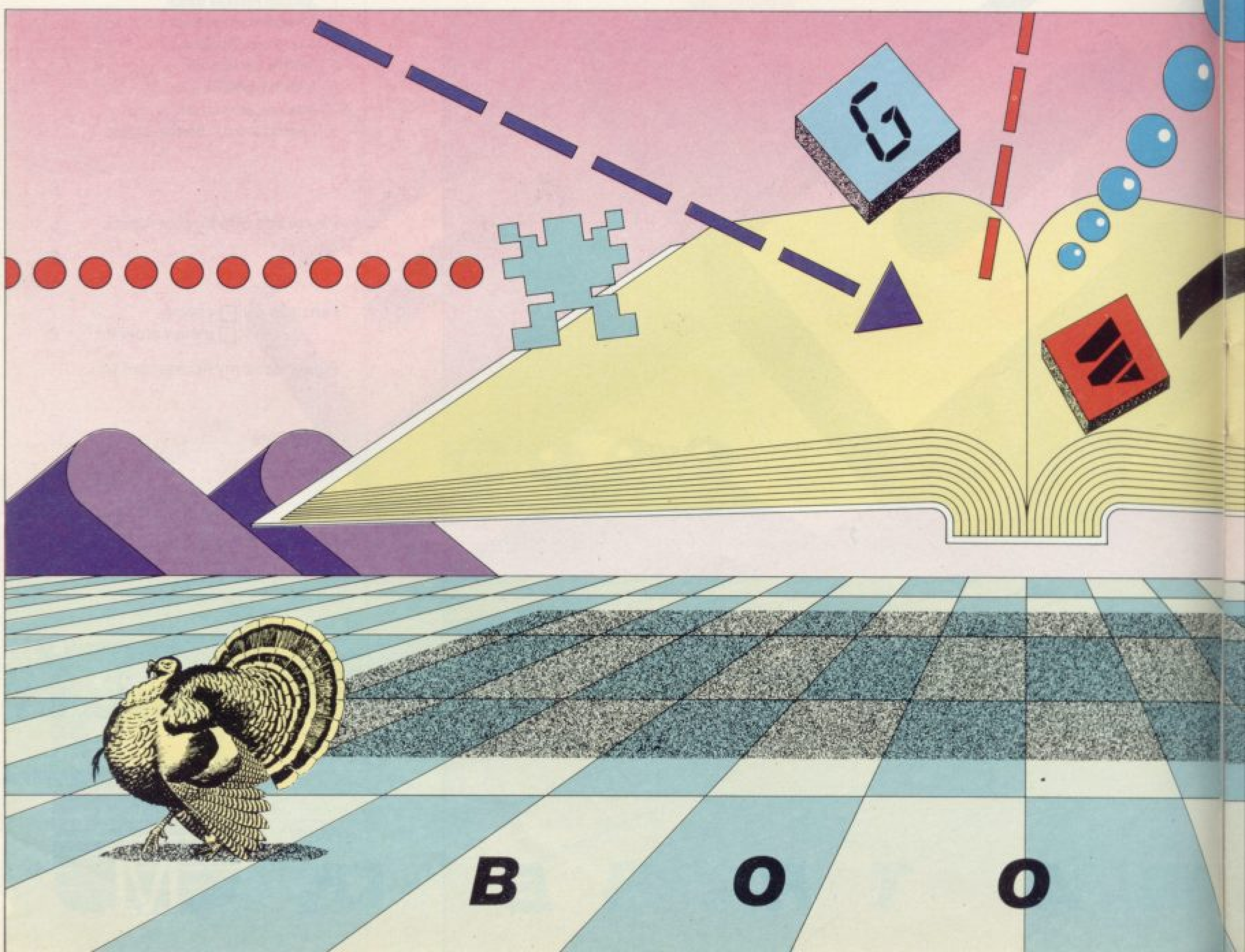
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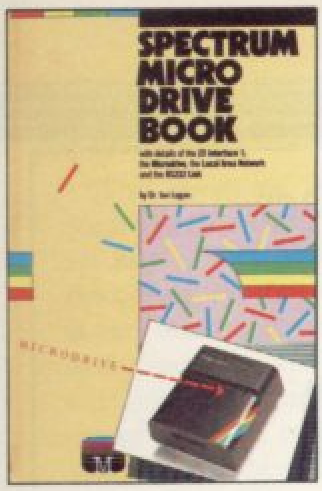
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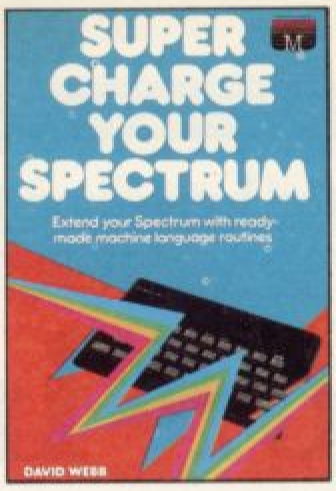
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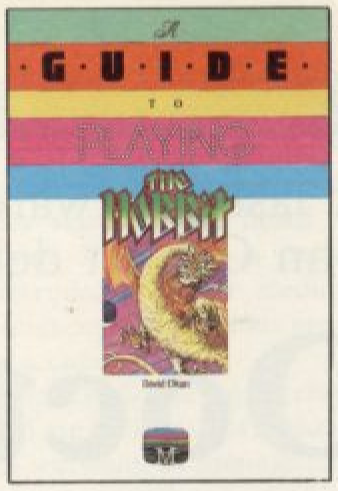




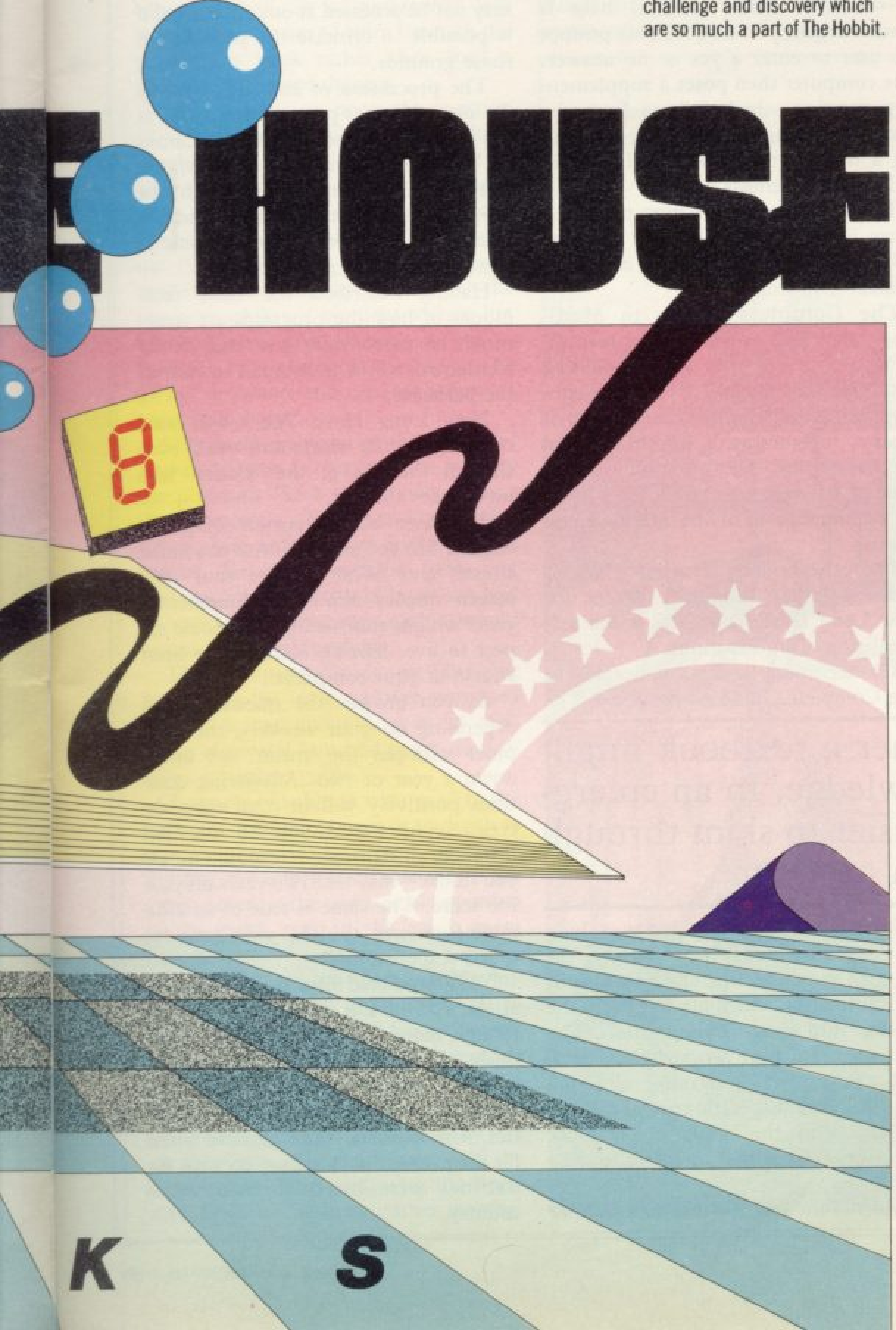
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GSH

At last—software for hypochondriacs. John Gilbert delivers the diagnosis

Doctor in the house?

WHEN people think about the various types of computer software they usually divide them into three main categories — games, educational and business. The classification is also normally in that order.

The Eastmead Medical series, however, fits into none of the three main categories completely. It could be placed in the educational field but it is also of use in the home and even in the surgery, or so the manufacturers claim, but its educational value is questionable.

A team of three worked on the development of the packages — two programmers and a successful medical author. That is made apparent by the textbook style of the narration on the screen, a style which invites comparison with medical reference books.

The screen layout of the text in each of the programs accommodates the reader in every way. There is a space between every line of text which should help the reader to avoid eyestrain. There is also an insurance measure incorporated into every screen so that you do not move to the next screen by pressing a key accidentally.

The only way to access the next screen is to press the key specified by the program, which is usually on the bottom row of the keyboard. Accidents can still happen if you lean against the keyboard but they are made less likely by that safety measure.

The usual psychological techniques of learning are applied in the packages. The most successful is the asking and answering of questions combined with a period of tuition.

It is difficult to spot the technique in the first of the series, **How Long Have You Got?** but it is there. On the first run through the package, which consists of one program, you will be asked a number of questions regarding health.

Once the program has finished and you have learned how long you can expect to live the computer will invite you to re-run and look at those questions with which you had difficulty and those which you answered incorrectly. In that case the questions would help you to analyse the problem areas of your life so far as health is concerned.

First Aid uses the questioning technique in a different manner. The program performs a diagnosis of what to do in situations where medical help is needed urgently. The questions prompt the user to enter a yes or no answer. The computer then poses a supplementary question which follows from the first. The string of questions, each going a little further than the first, will end with a diagnosis.

The diagnosis report may provide a direct form of action or may give the unhelpful response of 'go and seek medical help immediately'.

The Complete Guide to Medicine, the final part of the medical trilogy, does not use the questioning technique very much. It provides a rundown of reproduction and the growth of a baby, together with information on internal organs. The questions in that piece of software are mainly for switching between parts of the program and menus.

The other aid to learning which is apparent in the programs, except for How Long Have You Got? is the sectionalising of information.

The technique is most noticeable in The Complete Guide to Medicine. The authors have obviously spent a long time working out which part of the program should be first and how to split the information which has to go into the package into several 48K portions. The split seems to have worked fairly well with the medical programs, although long waits for a specific part of a package, such as the 'guide', can cause irritation, especially if there is a loading error.

Most of the sections take several minutes to load as they contain large amounts of information. When working through a program all the information may not be accessed at one sitting and it is possible to criticise the program on those grounds.

The processing of answers given by the user also uses program space but as the options to most questions are limited, the decision-making parts of the software are compact. Although the programs are written in Basic and not machine code, the computer response to a user input is extremely fast.

Having described the basic techniques of how the programs are structured, let us consider how each of the techniques works in relation to each of the packages.

How Long Have You Got? could certainly induce stress and could even shorten the life of the 'victim' who undertakes the test.

The user has to answer questions such as 'Do you smoke?' 'Are you under stress?' and 'What sex are you?' The screen display shows the number of years which, statistically, you could expect to live, barring accidents or heart attacks at your computer.

As you answer the questions and, depending on your answers, the computer will put the 'mean' age up or down a year or two. Answering questions positively will in most cases decrease your expectation of life. For instance, an affirmative response to 'Do you smoke?' may take two years off your life score. The same is true of an affirmative answer to 'Do you have too much responsibility?'

Your predicted lifespan is displayed at the end of the question section, although that is a rough estimate. Obviously, the program is light-hearted in content, although all the results are based on knowledge gained from statistics. Unfortunately the cassette insert for the package does not say on what the statistics were based or from which country.

'You must ponder whether a textbook might be a better source of knowledge. In an emergency you would find it easier to skim through a book rather than load a program'

The questions involved in the test seem sensible enough and it is easy to see how the resulting life expectancy is calculated, yet they are vague and there is only one which takes into account the male/female sex difference. That is not a major criticism of the product, although it makes one wonder if all eventualities have been taken into account.

The First Aid package deals with the kind of emergencies which happen in the home. The contents include dealing with bleeding, breathlessness, poisoning, fainting and convulsions although again not every eventuality is taken into consideration. For that reason you must ponder whether a textbook on the subject might be a better source of knowledge. After all, in an emergency you would find it easier to skim through the pages of a book rather than load a program for a consultation.

The last criticism poses the question as to the way in which the package should be used. If it is to be used in the classroom it is not sufficient to stand alone. At best it could be used only as a teacher's aid or learning prop. If that is not the case, surely the manufacturer cannot expect someone to LOAD the program while an accident victim lies on the floor. The package is not so portable as a textbook which can be carried anywhere and used for accidents away from home.

One major criticism of the First Aid package is that in many cases it gives the diagnosis 'Seek the advice of your doctor urgently'. That is not very helpful, as first aid is often applied while waiting for expert medical help; and you could buy a first aid book for half the price of the package and it would contain more information.

The Complete Guide to Medicine has, to say the least, an over-expressed title. It is not possible, even in textbooks of several hundred pages, to provide a complete guide.

A variety of subjects is covered in the package, although none is as in-depth as they could be. In the section on reproduction, the information starts with the sperm entering the woman. No mention of the man's part in the act is mentioned.

Other subjects covered include human anatomy and physiology, nutrition, how to cope with stress, emergencies, home care and nursing advice.

The authors have also included graphics in the sections on the body and its functions and those can only be described as funny and, with the Spectrum graphics facilities, rather sketchy. The authors are certainly not artists, as the graphics show square heads and strange-looking limbs. For a package which is intended to cover medicine, one of the sciences, the graphics are not sufficiently accurate.

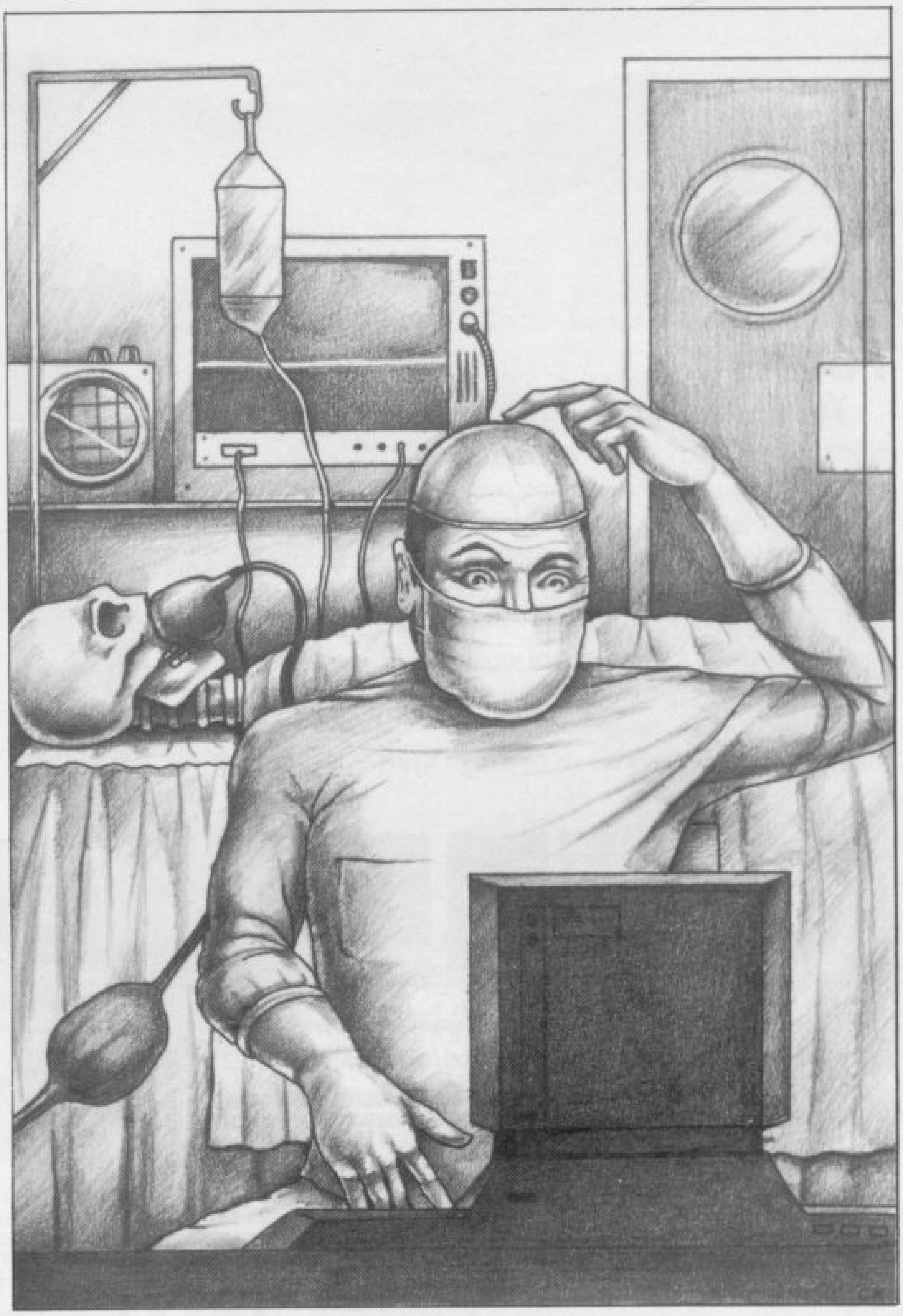
The Complete Guide to Medicine and First Aid are indicative of a distressing trend in software, as manufacturers and programmers attempt to find substitutes for the written word, working on the assumption presumably that anything a book can do, the computer can do better. In this instance that assumption is unfounded, as textbooks on the subject would be less superficial and contain illustrations considerably more illuminating. The access time alone should make users think twice before loading such software.

If the packages have an advantage over textbooks it is the provision of information in a palatable and amusing form for people who enjoy using computers and do not enjoy reading. How Long Have You Got? according to that criterion is the best of the three packages as it is the most fun to use.

FIRST AID
Memory: **48K**
Price: **£4.60**
Gilbert Factor: **4**

HOW LONG HAVE YOU GOT?
Memory: **48K**
Price: **£3.95**
Gilbert Factor: **6**

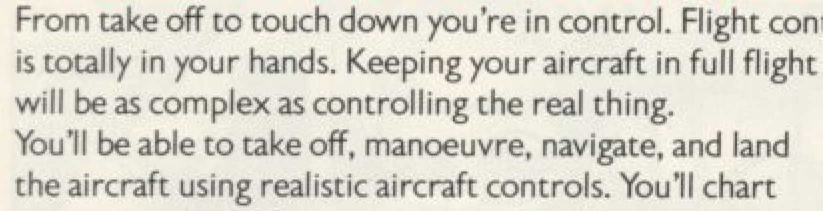
THE COMPLETE GUIDE TO MEDICINE
Memory: **48K**
Price: **£6.90**
Gilbert Factor: **4**





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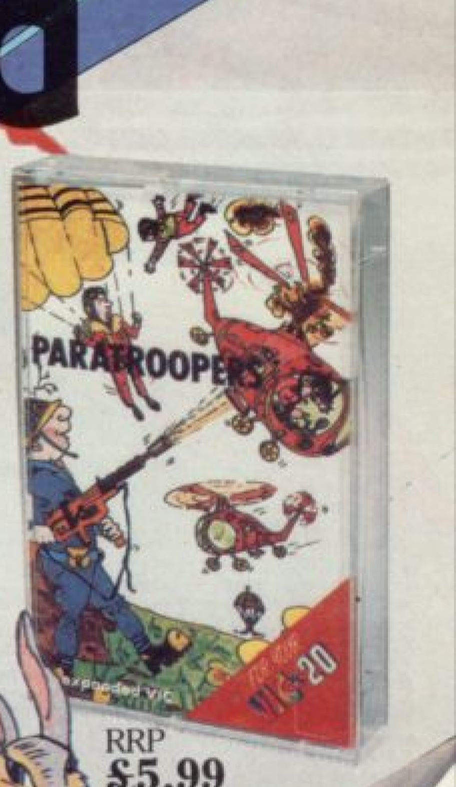
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Computer capers

John Gilbert reads more into two new books which aim to show the lighter side of computing.

IT HAD to happen. Someone has had the courage to print an exposé of the whole truth about the computer industry and its inmates. *Micromania,* by Charles Platt and David Langford, takes computing to pieces and finds the comedy under the skins of big business and the individual computer user. It does so by using a hatchet of slapstick humour with an ungainly mixture of cliches and buzzwords.

The book provides a compendium of insights into the personalities of those who use computers. The authors may be interested in the machines but they are ready to make fun of the behaviour of their fellow maniacs.

They divide users into four classes — the hardware freak, the video game nut, the end-user and the hacker. The descriptions of those people are as cruel as the names used to label them. A video games junkie is, for example, described as 'between 10 and 16 years of age, mentally if not physically'. The authors then describe video games as 'boring and, sooner or later, an intelligent person will notice this'. On the other hand, as the authors fail to admit, an intelligent person might not.

It is ridiculous to say that all video games players are idiots or morons. There are, of course, people addicted to those games, just as there are people addicted to barbiturates or aspirin, but many computer users play video games as a form of relaxation or entertainment. The criticism that computer users are junkies hooked on bashing a computer keyboard all day and night is, therefore, too general to be taken very seriously.

Micromania is also peppered with a long series of rules governing computers, called Platt's Laws. They cover all areas of computing and most of them make sense when the veneer of sarcasm is removed. For instance, 'the man who invests a lot in a system will swear by it in public, even if he swears at it in private' is funny but also true about ZX-81 owners who envy IBM owners. Also true is 'no matter how expensive you expect a system to be, it will always end up being more expensive than you expect'. Every micro owner would say that never a truer word was spoken.

The general structure of the book is inventive, to say the least. Each chapter is labelled with a binary number, beginning with 0000 and rising to 1101. The text is split into modules which is reminiscent of the way in which programs should be structured. It also shows that the authors are part of the computer world of which they are making fun.

Chapter 1101 deals with the future of microcomputing, a subject which would have been a glaring omission from a book dealing with the whole computer scene. The authors may ridicule the denizens of the computer industry but they agree that our future is in their hands:

"We can laugh all we like at micromanics, but they will have the last laugh — because they are designing the future that the rest of us will have to live in."

Micromania costs £7.95 in hardback and can be obtained from Victor Gollancz Ltd.



16. Typical hacker at work

The Naked Computer, by Jack Rochester and John Gantz, is similar to *Micromania* in its ridicule of the computer scene but it provides more anecdotes and concentrations on big business. The book starts by looking at the computer invasion and the most successful and unsuccessful computer ventures.

The most ubiquitous computer? The Commodore Vic-20, one million strong at the end of 1982. The least ubiquitous? The CDC G-20, of which there is one left.

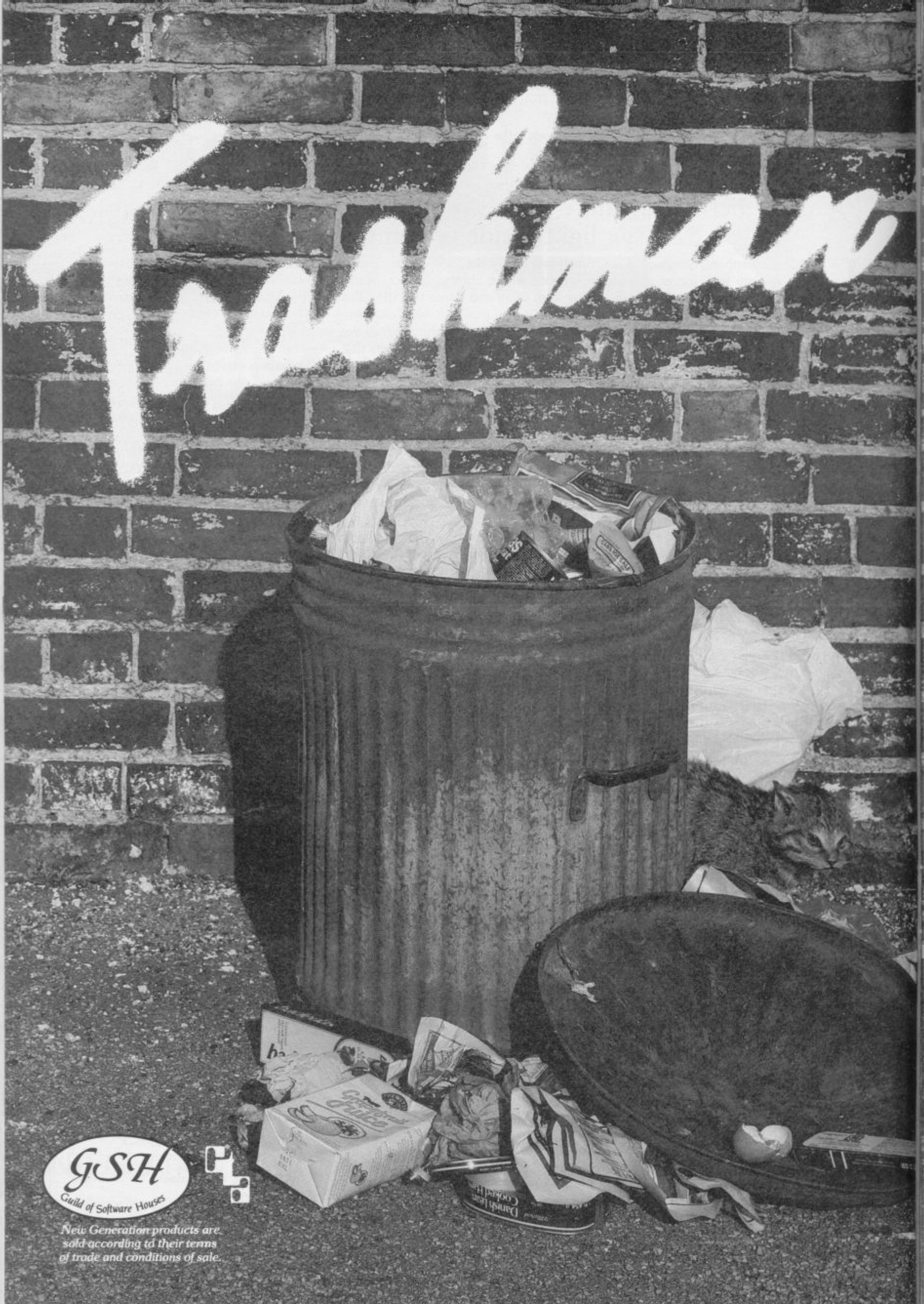
The future of high technology and information technology is discussed throughout the book, with a round-up in the last chapter. It is those parts of the book which are the most interesting and, possibly, most useful if you want to demonstrate your knowledge of computers. The style used to describe the innovations in technology is if anything too involved and few beginners would understand terms such as FOBS — fractional orbit bombardment system — charged particle beam and even satellite-mounted laser cannons. Few of those terms are explained in depth and it seems again that the authors are seeking a quick laugh.

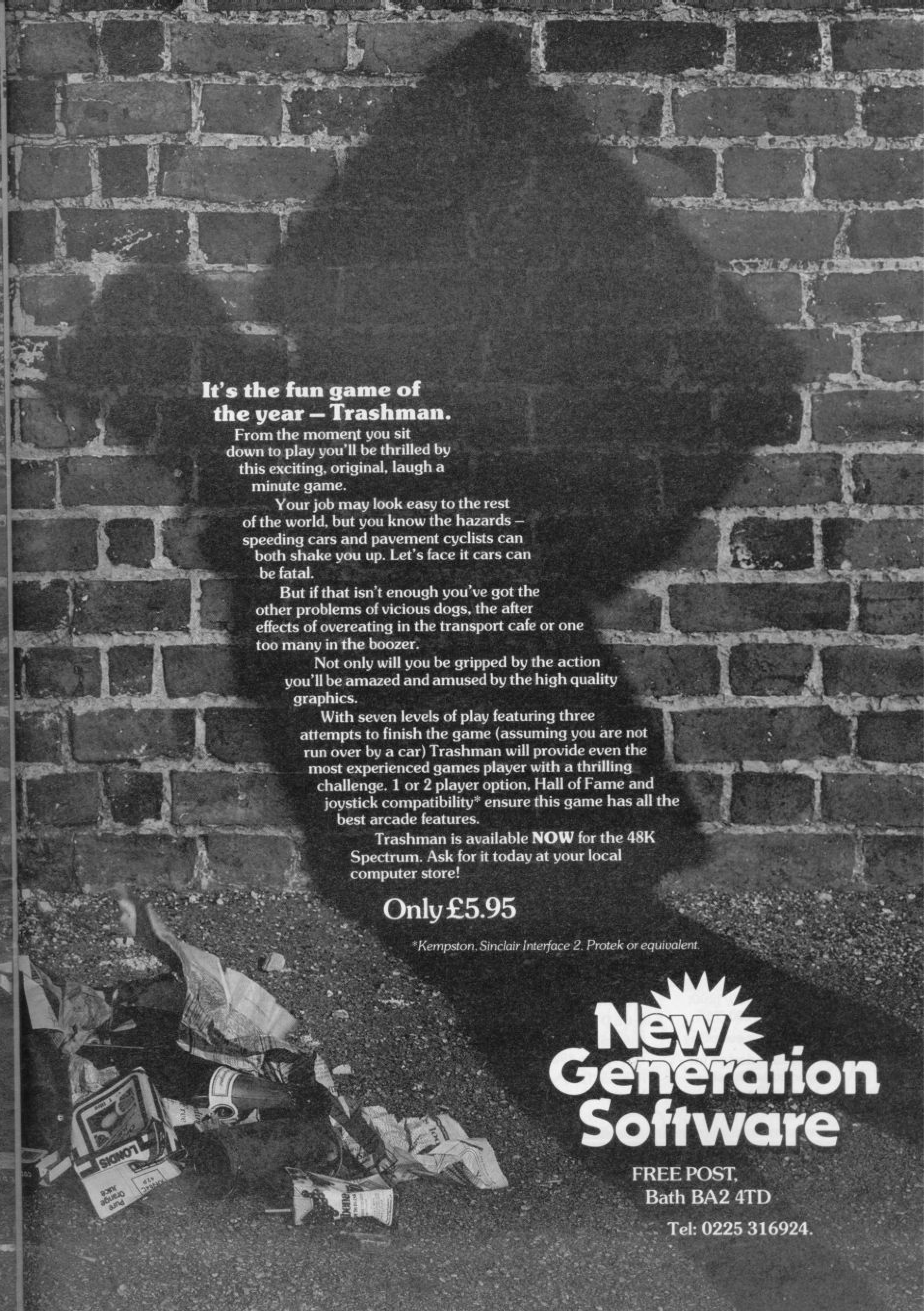
The final chapter, The Outer Limits, is like *Micromania* in that it tries to explain what could happen in the next few decades so far as technology is concerned. The book looks at new IBM projects, research into chip use done at Massachusetts Institute of Technology and the way in which robots are being used by the U.S. Army. What it does not explain is the incredible influence the home computer industry is likely to have on the prices of computer-related components, such as RAM chips, and whether the home industry will have a good or adverse effect on high technology and information technology in the long run.

Like all the other chapters, The Outer Limits is a collection of anecdotes, although some of the authors' thoughts are included. The book leaves the reader with the feeling that the authors were afraid to approach the subject in anything but the impersonal third person. The authors give their views only a few times and they are only as postscripts to yet more anecdotes.

Despite that, *The Naked Computer* is an enjoyable book. It costs £9.95 in hardback and can be obtained from Arlington Books.

Victor Gollancz Publications, 14 Henrietta Street, London WC2.
Arlington Books, Clifford Street, Mayfair, London W1.


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OVER £4 000 TO BE WON IN THE SINCLAIR USER AND CCS

1984 CAMBRIDGE AWARDS

SINCLAIR USER and Cases Computer Simulations announce the 1984 Cambridge Awards for programming, the annual competition to find top programmers for Sinclair computers. This year we are offering a first prize of £2,000 plus royalties to the programmer of the most innovative and appealing game for the Spectrum, ZX-81 or, in the unlikely event of anyone receiving one, the QL computer. The award winner will also be presented with the Cambridge Trophy for programming.

In addition to the first prize there are four second prizes of £250 each plus royalties and 25 runners-up prizes of five CCS programs. All prize-winners will receive a free annual subscription to *Sinclair User*.

We are looking for exciting adventure, strategy and simulation games. Entries will be judged for originality and innovation, playability and addictive quality, graphics, sound and the use which is made of the computer. The presentation of the instructions and the program documentation will also be taken into account.

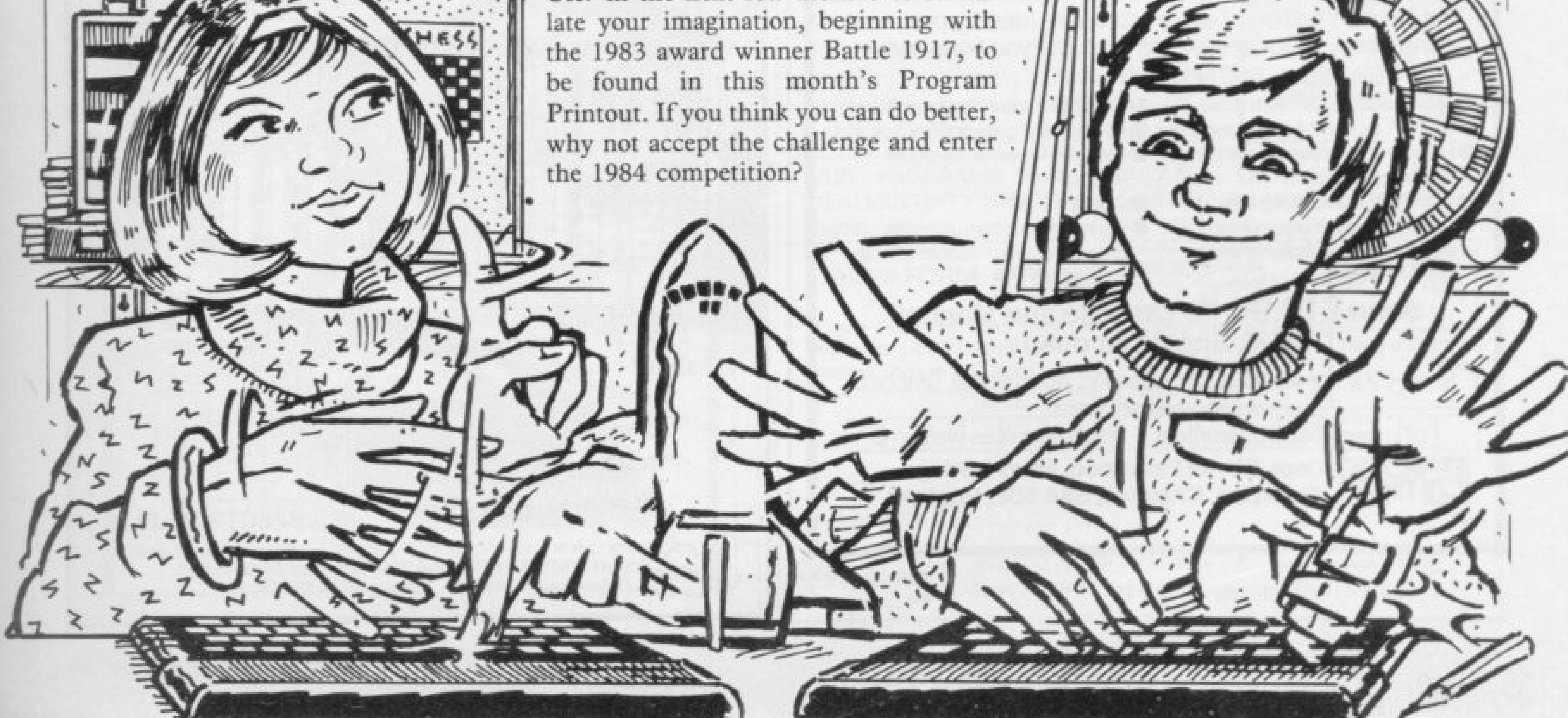
Last year a fascinating variety of games was received, ranging from the



complexity of war games **Battle 1917** and **War 70,** through the mind-boggling business simulation **Oligopoly,** to the mysterious, shadowy adventure worlds of **Broodslayer** and **Barrows Quest.** Those, and other programs submitted, will be published in *Sinclair User* in the next few months to stimulate your imagination, beginning with the 1983 award winner Battle 1917, to be found in this month's Program Printout. If you think you can do better, why not accept the challenge and enter the 1984 competition?

- Entries must be on cassette accompanied by a listing, detailed explanation of the program and an entry form. The entry form will be printed in the June issue of *Sinclair User.* Entrants must warrant that their programs are original.
- Only programs for the QL, Spectrum or ZX-81 will be considered.
- Entries must reach *Sinclair User* at 196-200 Balls Pond Road, London N1 4AQ not later than Wednesday, August 4.
- Entries will not be returned and no correspondence can be entered into between entrants and organisers. The judges' decision will be final.
- Employees of ECC Publications and CCS and their associated companies are ineligible.

More information, including the list of judges and the entry form, will be given in the June issue of *Sinclair User.* In the meantime, start programming.



GAMES FOR BOYS



GAMES FOR GIRLS



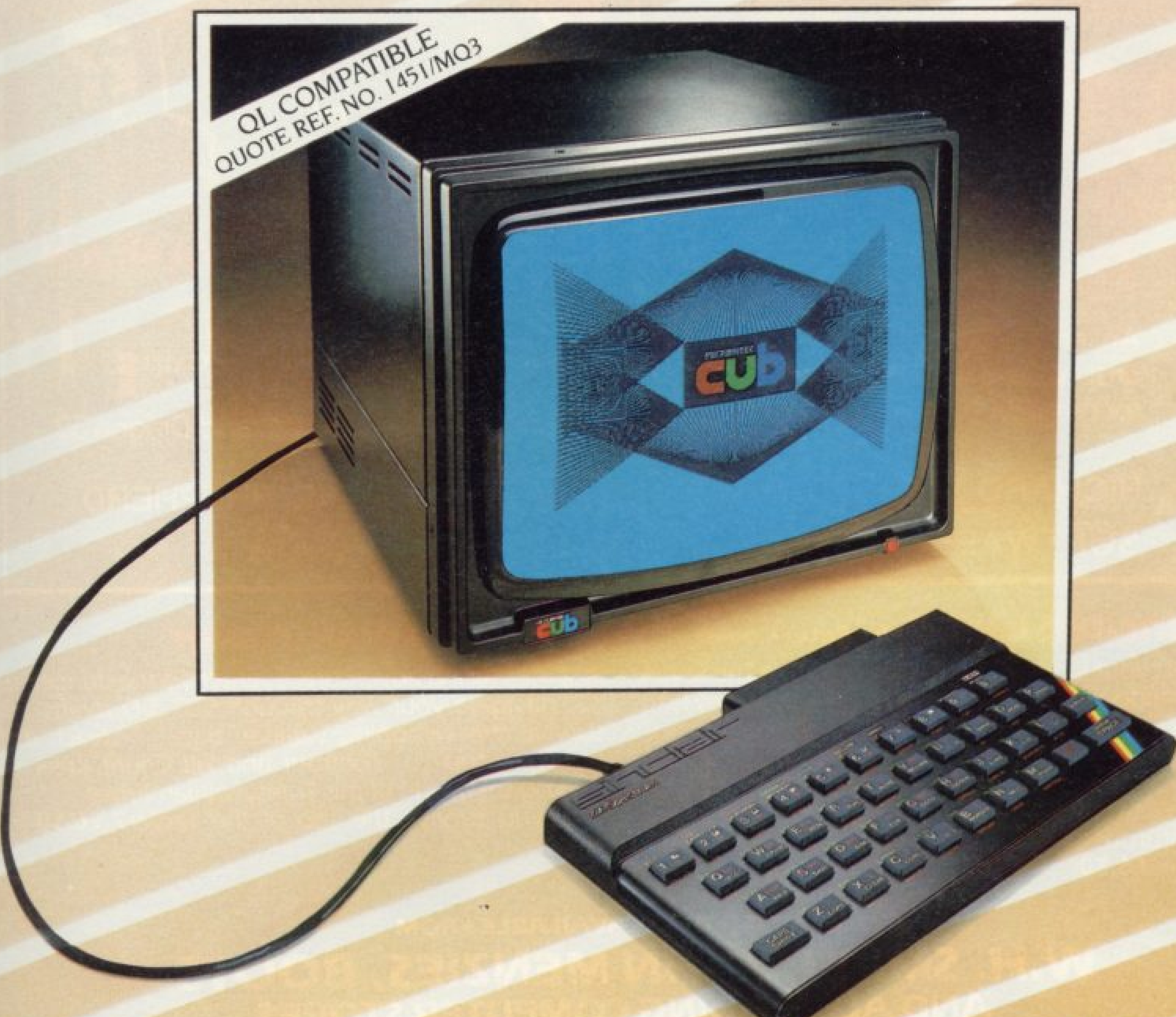
All available for Spectrum 48K at £5.95. Selected titles available from larger branches of Boots, Greens, John Lewis Partnership, Rumbelows, W.H. Smith and all good computer shops or mail order from

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Strategy Games. They're no pushover.

WHEN IT COMES TO DISPLAYING THE SPECTRUM...



WE'VE AN IMPRESSIVE LEAD

Surprisingly enough, there's only one high performance BEAB approved colour monitor on the market with an input designed to accept the signal from the Sinclair Spectrum direct.

This same monitor also features a second input to receive T.T.L. signals for use with other micro computers including the BBC B.

This impressive lead over the competition in design specification is more than matched by the brilliance of the colour display, thanks to a standard resolution screen 585 pixels high by 452 wide, and a bandwidth of 18 MHz.

Needless to say, this gives colour reproduction far in excess of that available from an ordinary television.

And the monitor in question? – **The 1431/MZ from the MICROVITEC range of CUB colour displays.**

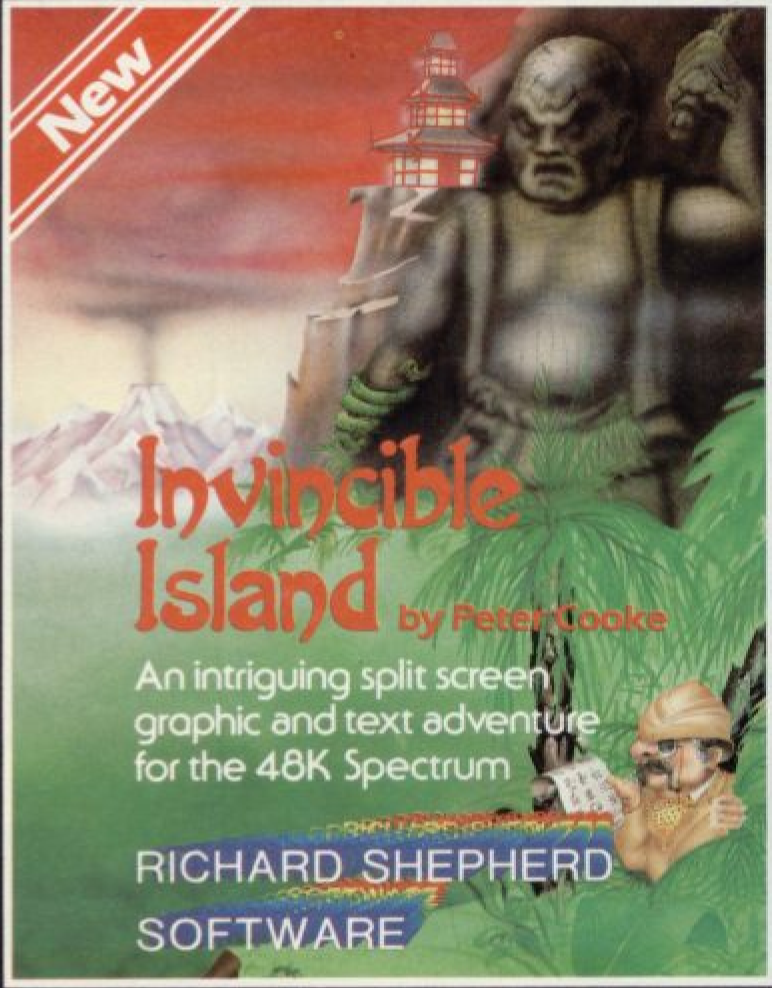
Call at your local dealer or contact us now and we'll rush you full information.

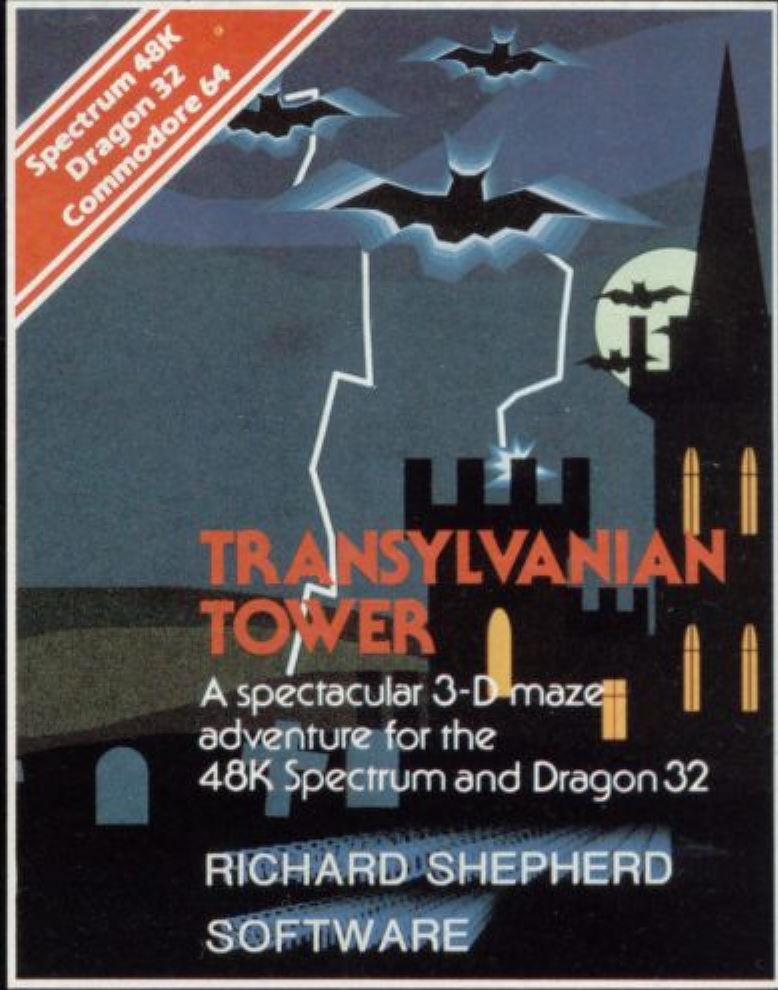
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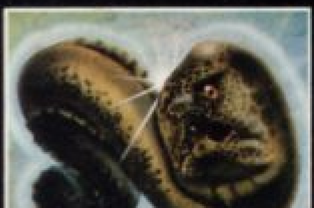
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A spine chilling adventure . . . enter via the dungeons . . . navigate your way through 500 3-D rooms . . . survive the swooping vampire bats . . . reach the terrifying top . . . confront and kill Count Kreepie, ridding the world of this Transylvanian Terror. Can you survive the Top of the Tower? **£6.50.**

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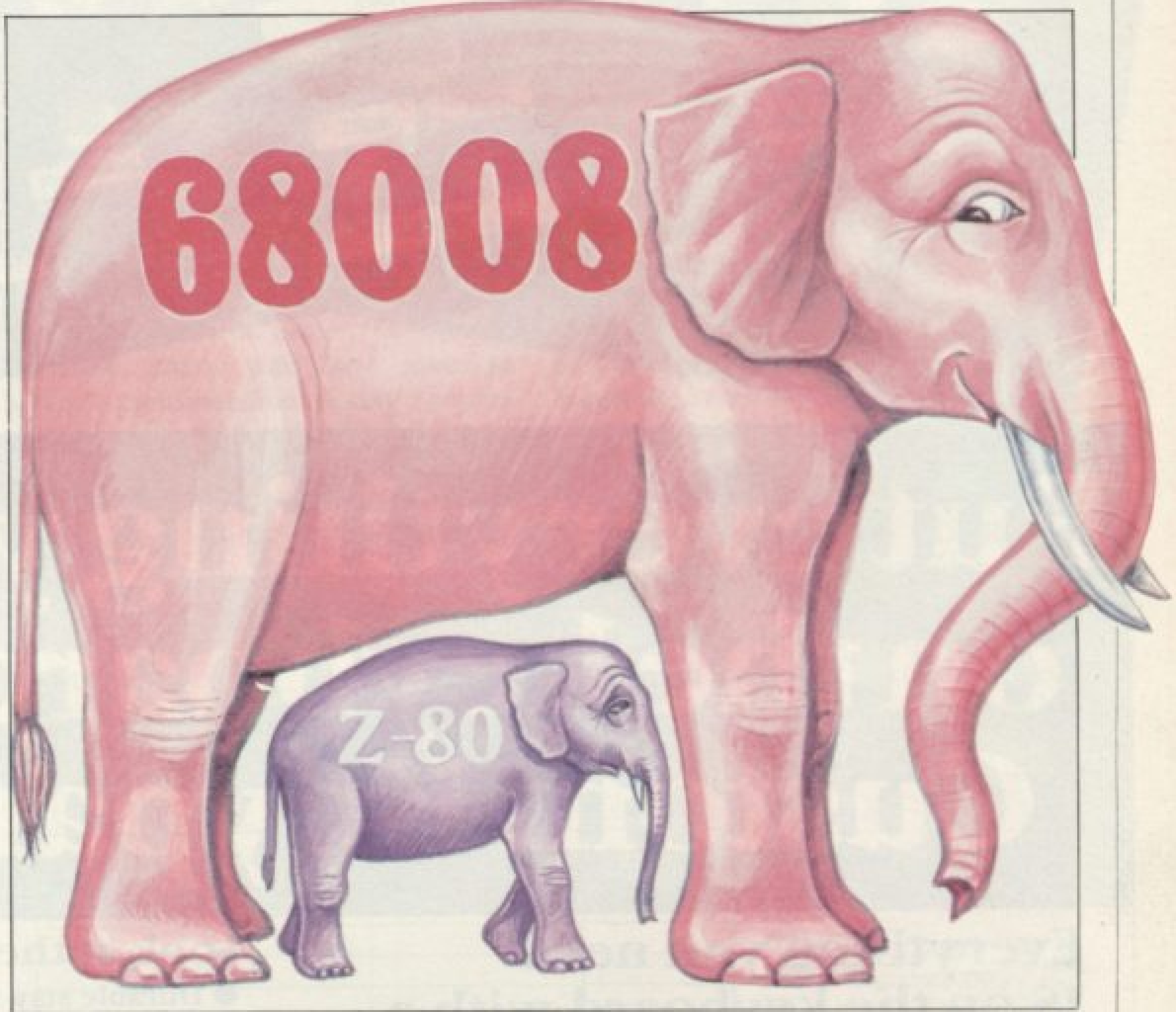




NEW DEALERS WELCOME — RING (06286) 63531 FOR DETAILS

68008 versus Z-80

While waiting for Sinclair Research to deliver the goods, the computer press has been arguing over the size of the powerful Motorola chip at the heart of the QL. John Kerrigan joins the fray



HOW WILL the power of the 68008 help ordinary users of Basic, as well as those who use machine code?

With a more powerful microprocessor you can either perform arithmetic to a greater degree of accuracy in the same time or you can speed the execution of the same calculations. Each time you use a variable in Basic, the ROM program in the machine stores the number split within set limits of accuracy.

With the Z-80, small portions of a variable are manipulated separately with separate machine code instructions. Each of those instructions takes a little time to operate. With a more powerful processor the number of such portions can be reduced.

The greater memory of the QL allows word processor programs to store more words. It allows business accounting programs to hold more data for a bigger number of transactions on a greater number of accounts; it also reduces the need for discs and makes Sinclair Microdrives a sensible proposition for more business accounting functions.

Traditionally, business accounting programs have worked by keeping only a small portion of a file in internal memory. They can adjust single records in the middle of a file held in external memory if that external memory is on disc. Microdrives make that more difficult. A bigger internal memory makes it less necessary because, for many medium-sized businesses, it may be possible to hold the whole of some of their accounting files internally.

The microprocessor chosen for the QL represents an abrupt change of direction for Sinclair Research. The 68008 is much more powerful than the Z-80 and it is also designed by a different company with a different computing philosophy. Zilog developed the Z-80 and Motorola the 68000 series.

Enthusiasts for the Z-80 would describe it as "internally 16-bit" because register pairs can perform some 16-bit arithmetic. The Z-80 is, however, essentially an 8-bit microprocessor, both internally and externally. That means that internally each single register is eight bits wide and externally the Z-80 can send or receive data a maximum of eight bits at a time.

Internally the 68008 is a true 32-bit microprocessor. That means that each register is a full 32 bits wide. Each register on the Z-80 can take only 256 different states or 2 to the power of 8, whereas each register on the 68008 can take 4,294,967,300 states, or 2 to the power of 32.

The main Z-80 rival is the 6502, the processor used in BBC, Commodore and some Apple machines. Compared to the 6502, the Z-80 has a large number of registers but the index registers and the shadow registers are inflexible and the fairly flexible registers for general use amount to seven. One of the seven can be used as an 8-bit accumulator, i.e., the A register can be used for 8-bit addition and subtraction. Another two, H and L, can be used together for certain 16-bit accumulator operations.

The 68008 has eight of those large 32-bit data registers and each can be used as an accumulator. If you are accustomed to machine code with the Z-80 you are probably used to storing the result immediately after arithmetic so that H, L or A can be used for the next operations. On the 68008, eight separate calculations could be done one after another without moving the results from their separate registers.

It is an essential part of the philosophy behind 68000 series design that there should be "consistency" between registers, instructions and data types. In other words, anything you can do with one data register you should be able to do with all the others.

I have just used the odd term "data register". The reason for adding the word "data" is that, apart from the eight data registers, the 68008 also has seven "address registers". The distinction between holding an address or data in a register pair of the Z-80 normally is maintained solely in the mind of the programmer. For the 68008, the distinction is more clear-cut because there are 14 addressing modes and their full

continued on page 63

continued from page 61

use depends on dextrous use of the address registers.

Sadly, Motorola has not given those registers exciting names. Early computers all had accumulators and some had byte counters and high and low pointers. Zilog reduced those names to A, B, C, H and L. Motorola calls its data registers D0, D1 to D7 and its address registers are called A0 to A6.

There are two purpose-made stack pointers on the 68008. As one would expect, there is also a program counter register and a status register. The status register is similar to but more sophisticated than the flag register on the Z-80. One of the stack pointers is for the programmer's use to provide a temporary store for data. The other is used on operations such as calls to subroutines and is not available directly to the programmer. Both are sometimes called A7.

As with data registers, there is an attempt at consistency between address registers. There are addressing modes which have the effect of allowing you to treat A0 through to A6 as if they were pointers to separate stacks.

On the Z-80 each address is 16 bits long. That means the maximum directly-addressable memory which can be attached to a Z-80 is 64K — 64K or 65536 is the same as 2 to the power of 16. The Spectrum has 16K ROM and that leaves a maximum of 48K for the RAM. There are Z-80-based machines with more than 64K internal memory but that is achieved by alternating between different banks of memory occupying the same addresses. At any time only 64K can be addressed directly by a Z-80.

On the 68008, each address is 20 bits long. That means the maximum directly-addressable memory is one megabyte — or 1,048,566, which is 2 to the power of 20. In practice, the QL is being sold with "only" 128K RAM but, no doubt, add-on RAM packs will become available if there is a demand. As usual, each address in internal memory can hold one byte.

The 68008 is related closely to the 68000. It has the same instruction set but the size of the address bus and the size of the data bus are two significant differences. The buses refer to the pins on the edge of the chip — the physical connections for passing address and data information to and from the microprocessor. The 68000 has a 16-bit data bus and the 68008 has only an 8-bit data bus.

The close relationship between the 68000 and the 68008 has led some commentators to call the 68008 a 16-bit microprocessor. The size of the internal registers has led others to call it a 32-bit microprocessor, while the size of the data bus leads some to call it an 8-bit microprocessor. Perhaps it is most informative to call it internally 32-bit and externally 8-bit.

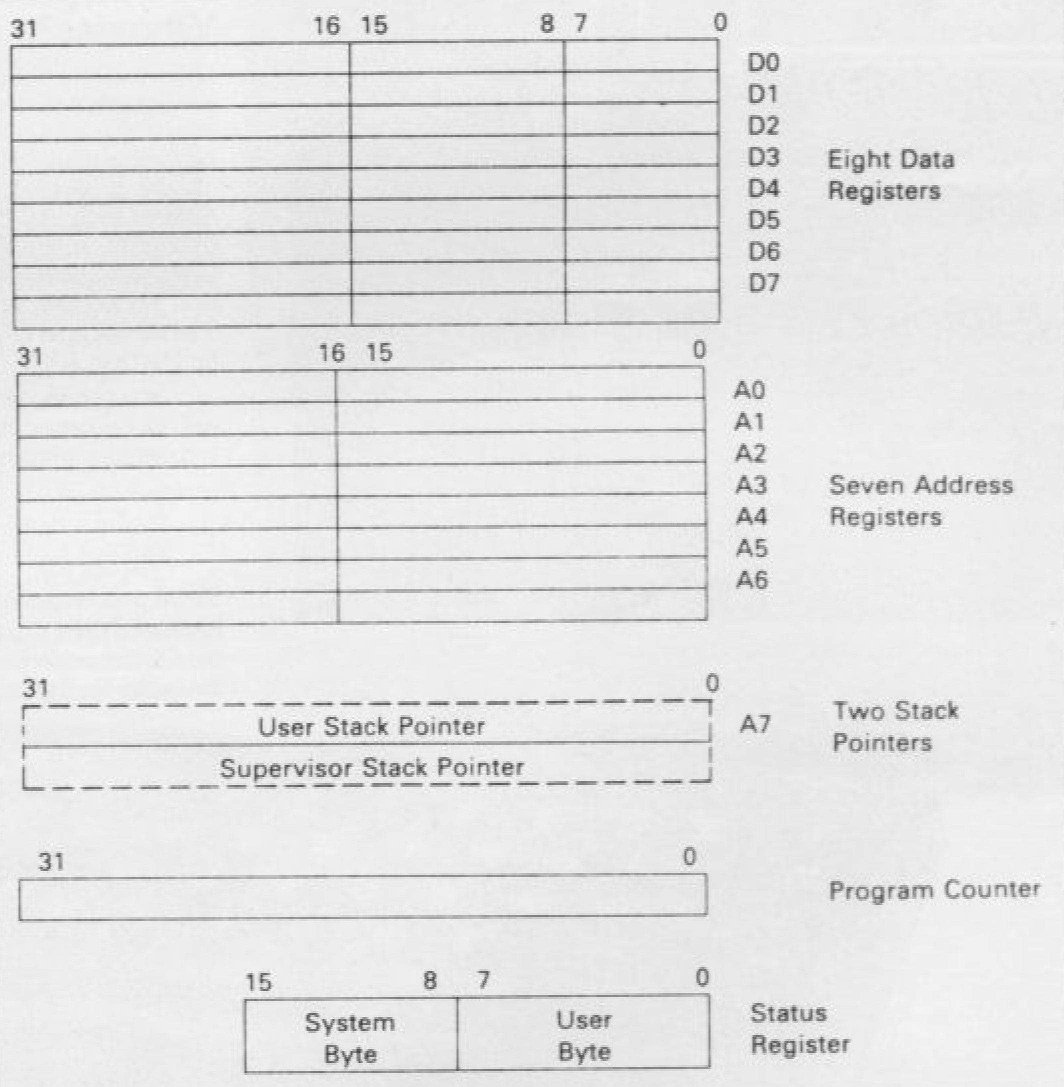
The size of the data bus means that four physical movements are required to load a full data register from internal memory. That is transparent to the user in the sense that one instruction performs the whole load. It means that the 68000 will be slower than the 68008.

There are no direct multiply or divide instructions on either the 6502 or the Z-80. Many who have mastered binary multiplication using rotates might consider it cheating for a machine code instruction set to include them. Needless to say, the 68000 set does that. It also allows you to perform all arithmetic on several data types including bytes, words and long words. Words are 16 bits long and long words are the full 32 bits long.

Another change which will surprise Z-80 programmers is the number of debugging functions built into the hardware. There is an automatic trap to prevent the division by zero. There is a trap instruction so that a machine code routine can be debugged portion by portion.

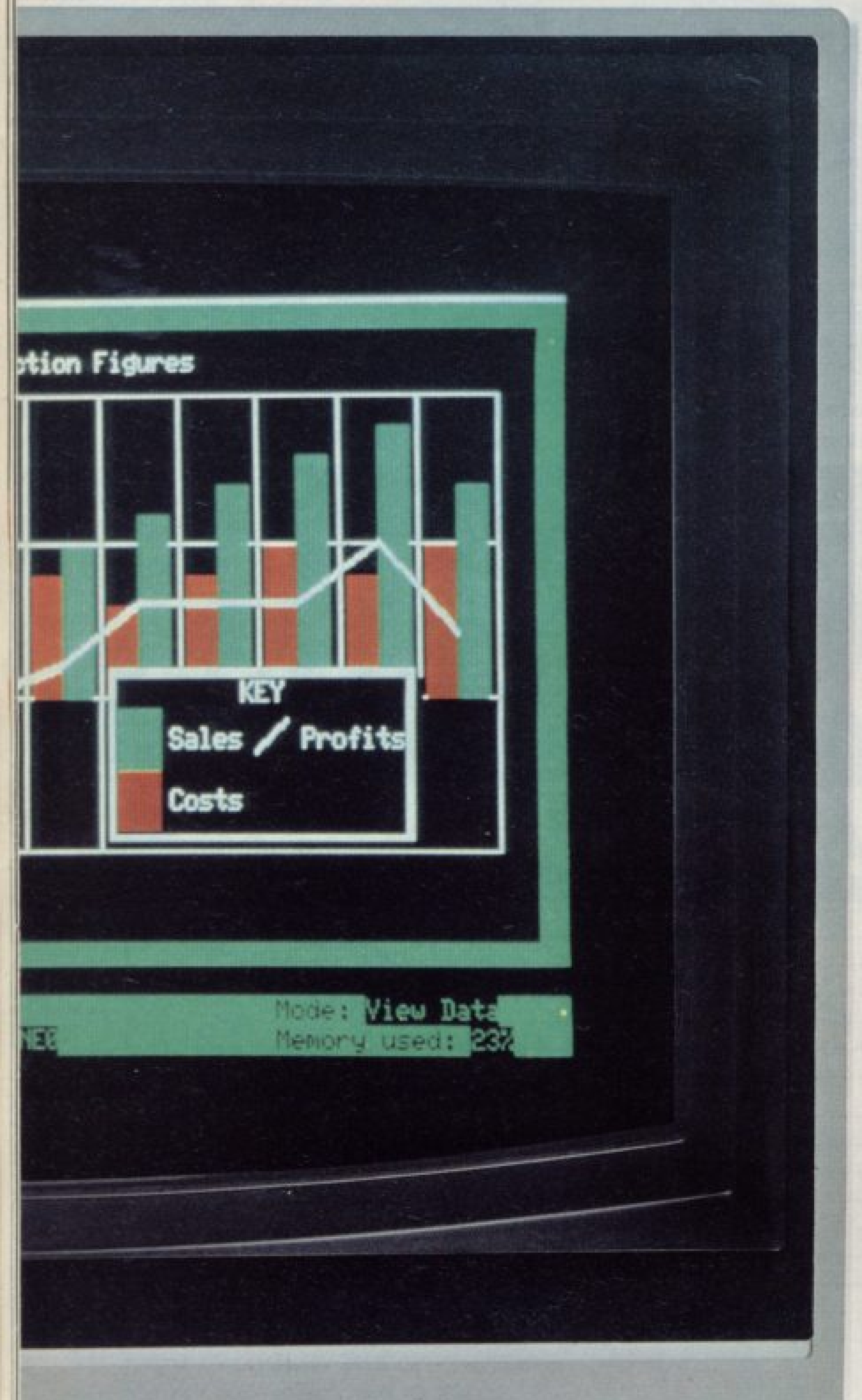
Those traps divert the path of execution by pushing a set address into the program counter. That allows the development programmer to test to ensure that his routine will reach a certain point in the program and then to test the register and memory values. There is even a trace facility built into the hardware. You may be used to those in software tools and high-level languages such as Basic but with the 68000 series they are built into the chip.

Are there any advantages for the good old Z-80 over the 68008? Well, more bigger registers, more stacks, more subtly different addressing modes, will certainly give scope for more complicated bugs and mistakes and the Z-80 repeating instructions, LDIR, LDDR and CPIR are a joy. They are subroutines within a single instruction. I have a sneaking suspicion that the designers of the 68000, with their purist search for consistency, would not approve of such light-hearted additions to the instruction set.



68000 register set

New–Sinclair QL
There's no comparison chart, b



The Sinclair QL is a new computer.

Not just a new Sinclair computer, but a totally new sort of computer – nothing like it exists anywhere.

It's not just a bit better than this, or a bit cheaper than that – it's a computer that's very hard to compare with anything. Just check the features below – and if you don't agree, take up the challenge at the end of the advertisement.

If you do agree, there's only one course of action you can take… get yourself a Sinclair QL at the earliest possible moment.

The Sinclair QL has 128K RAM. Big deal?

Several micros offer 128K RAM, or more, as standard. The 'What Micro?' table for December 1983 lists over 50 of them – but 40 of the 50 micros listed cost over £2,500!

The Sinclair QL offers you 128K RAM for under £400, and an option to expand to 640K. That's a lot of bytes to the pound!

The Sinclair QL has a 32-bit processor. Who else?

Under £2,700, nobody. Even the new generation of business computers, such as the IBM PC, are only now beginning to use 16-bit processors.

At prices like this, the Motorola 68000 family – widely regarded as the most powerful microprocessors available – will remain a luxury.

Yet with the Sinclair QL, the 32-bit Motorola 68008 is available for less than £400.

You can also be sure that the QL will not become outdated. 32-bit architecture is future-proof.

32-bit processor architecture, 128K RAM, and QDOS combine to give the QL the performance of a mini-computer for the price of a micro.

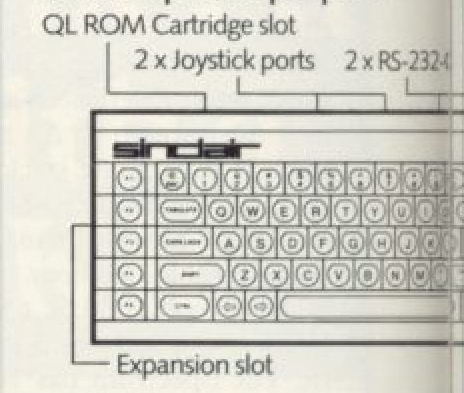
Exclusive: new QDOS operating system

No competition! QDOS sets a new standard in operating systems for the 68000 family of processors, and may well become the industry standard.

QDOS is a single-user, multi-tasking, time-sliced system using Sinclair's new SuperBASIC as a command language.

One of its most significant features is its very powerful multi-tasking capability – the ability to run several programs individually and simultaneously. It can also display the results simultaneously in different portions of the screen. These are features not normally available on computers costing less than £7,000.

Eleven input/output ports



New professional keyboard

The QL keyboard is designed for fast input of data and programs.

It is a full-size QWERTY keyboard, with 65 keys, including a space bar; left-and right-hand shift keys; five function keys; and four separate cursor-control keys – key action is positive and precise

A membrane beneath the keyboard protects the machine from dust (and coffee!), and for users who find an angled keyboard more comfortable, the computer can be raised slightly at the back by small detachable feet.



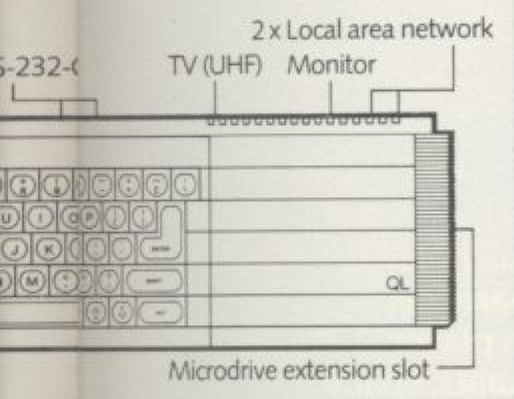
£399

...because there's no comparison!

Advanced new friendly language – Sinclair SuperBASIC

The new Sinclair SuperBASIC combines the familiarity of BASIC with a number of major developments which allow the QL's full power to be exploited.

Unlike conventional BASIC, its procedure facility allows code to be written in clearly-defined blocks; extendability allows new procedures to be added which will work in exactly the same way as the command procedures built into the ROM; and its constant execution speed means that SuperBASIC does not get slower as programs get larger.



Two 100K microdrives built in

The Microdrives for the Sinclair QL are identical in principle to the popular and proven ZX Microdrives, but give increased capacity (at least 100K bytes each) and a faster data-transfer rate. Typical access speed is 3.5 seconds, and loading is at up to 15K bytes per second. The Sinclair QL has two built-in Microdrives. If required, a further six units can be connected.

Four blank cartridges are supplied with the machine.



™Quill, Easel, Archive and Abacus are trade marks of Psion Ltd.

Included – superb professional software

The suite of four programs is written by Psion specially for the QL and incorporates many major developments. All programs use full colour, and data is transportable from one to another. (For example, figures can be transferred from spreadsheet to graphics for an instant visual presentation.)

Word-processing

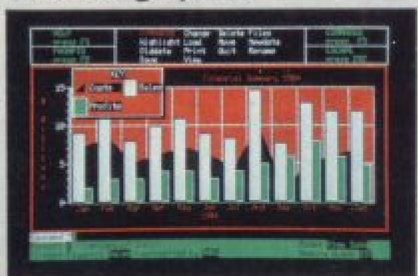


Certain to set a new standard of excellence, QL Quill uses the power of the QL to show on the screen exactly what you key in, and to print out exactly what you see on the screen.

A beginner can be using QL Quill for word-processing within minutes.

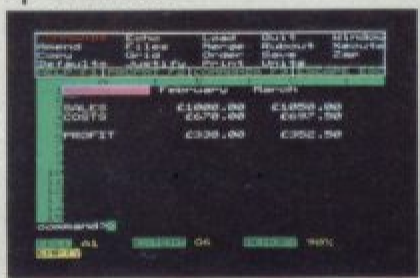
QL Quill brings you all the facilities of a very advanced word-processing package.

Business graphics



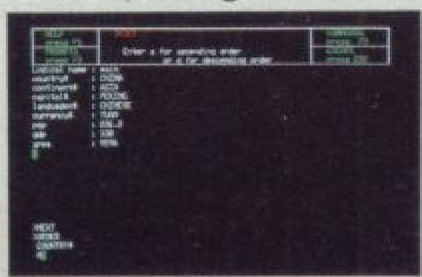
QL Easel is a high-resolution colour program so easy to use you probably won't refer to the manual! It handles anything from lines, shaded curves or histograms to overlapping or stacked bars or pie charts. QL Easel does not require you to format your display before entering data; it handles design and scaling automatically or under your control. Text can be added and altered as simply as data.

Spreadsheet



QL Abacus makes simultaneous calculations and 'what if' model-construction easier than they've ever been. Sample applications are provided, including budget-planning and cash-flow analysis. QL Abacus allows you to refer to rows, columns and cells by names, not just letters and numbers. Function keys can be assigned to change a variable and carry out a complete 'what if' calculation with a single key-stroke.

Database management



QL Archive is a very powerful filing system which sets new standards, using a language even simpler than BASIC. It combines ease of use for simple applications – such as card indices – with huge power as a multi-file data processor.

An easy-to-use labelling facility means that you don't have to ask for your file by its full name – a few letters are enough.

New – the Sinclair QLUB

The QLUB is the QL Users Bureau. Membership is open to all QL owners. For an annual subscription of £35, QLUB members receive one free update to each of the four programs supplied with the QL, and six bi-monthly newsletters. Sinclair has also made exclusive arrangements for QLUB members to obtain software assistance on QL Quill, Abacus, Archive or Easel by writing to Psion.

The Sinclair QL challenge

If you're seriously considering any other computer, post the coupon for a blow-by-blow comparison. We'll take a *published* comparison chart for the machine you're considering (not one we've created ourselves) and give you the Sinclair QL figures, detail by detail.

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– have your credit card (Access, Barclaycard, Trustcard) number ready. It may be possible to extend your existing credit limit. Please ask our telephone staff for more details.
Please do not use this number for other enquiries.

For more information

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Due to demand, delivery may take more than 28 days. Your order will be acknowledged immediately with an expected shipment date. Remember that Sinclair offers a 14-day money-back undertaking.

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Qty	Item	Code	Item Price £	Total £
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	QLUB membership (one year)	6100	35.00	
	Postage & packing (any order over £390)	6999	7.95	

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☐ Please send me a chart comparing the Sinclair QL computer with a________

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Sinclair Research Ltd, Stanhope Road, Camberley, Surrey, GU15 3PS.

PROGRAM PRINTOUT

Instructions for graphics characters are printed in lower-case letters in our listings. They are enclosed by brackets and separated by colons to distinguish them and the brackets and colons should not be entered.

Inverse characters are represented by the letter "i" and graphics characters by "g". Thus an inverse W would be represented by "iw", a graphics W by "gw", and an inverse graphics W by "igw".

Spaces are represented by "sp" and inverse spaces by "isp". Whenever any character is to be used more than once, the number of times it is to be used is shown before it, together with a multiplication sign. Thus "6*isp" means six inverse spaces and "(g4:4*i4:g3)" would be entered as a graphic four, followed by an inverse four repeated four times, followed by a graphics three.

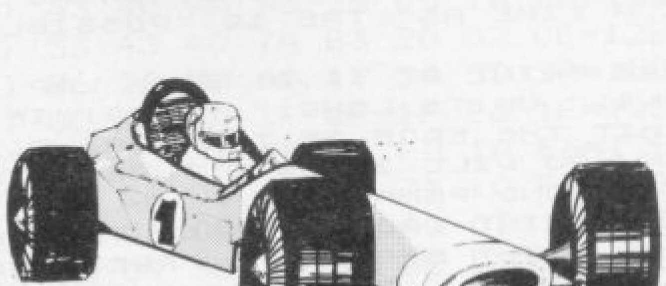
Where whole words are to be written in inverse letters they appear in the listings as lower-case letters. Letters to be entered in graphics mode on the Spectrum are underlined.

Inverse characters may be entered on the ZX-81 by changing to graphics mode and then typing the appropriate characters and on the Spectrum by changing to inverse video and typing the appropriate letters. Graphics characters may be entered on the ZX-81 by changing to graphics mode and then pressing symbol shift while the appropriate characters are entered. On the Spectrum graphics characters may be obtained by changing to graphics mode and then pressing the appropriate character. User-defined graphics will appear as normal letters until the program has been RUN.

FORMULA ONE

STEER YOUR HIGH-SPEED, five-gear racing car round the track as you compete in the Sinclair Grand Prix. Your time, distance travelled and gears are displayed on the screen and a three-second penalty is incurred if you crash into the barriers. **Formula One** was written by Peter Dziwior of South Croydon, Surrey and was the winner of the 16K ZX-81 section of our Christmas Competition.

To enter the program type in the Basic listing and SAVE it. Then type RUN 9000 and enter each pair of characters in the hexadecimal listing in turn, e.g., the first characters to be entered will be 97 and the next pair will be 00. The program will convert the hexadecimal numbers entered into decimal and POKE the machine code into lines 1 to 8. After every eight pairs of characters their total (checksum) will be shown. If you have made a mistake enter "X" to re-enter the last set of characters. Finally SAVE the program and press RUN. Lines 9000 onwards can then be deleted.



```
   1 REM ..........................................................
   2 REM ..........................................................
   3 REM ..........................................................
   4 REM ..........................................................
   5 REM ..........................................................
   6 REM ..........................................................
   7 REM ..........................................................
   8 REM ...............
 100 SLOW
 110 CLEAR
 120 DIM R$(984)
 130 LET LENH=INT (LEN R$/256)
 140 LET LENL=LEN R$-LENH*256
 150 LET ST=PEEK 16400+256*PEEK
16401+6
 160 POKE 16506,INT (ST/256)
 170 POKE 16507,ST-256*PEEK 1650
8
 180 LET L$=STR$ (LEN R$+16)
 190 DIM T$(6)
 200 POKE 16418,0
 490 REM -----
 500 REM ■ SUBROUTINES
 510 LET TITLE=1000
 520 LET INSTRUCTIONS=2000
 530 LET PLAY=3000
 550 LET BORDER=5000
 560 LET TRACK=6000
 600 GOSUB TITLE
 620 GOSUB INSTRUCTIONS
 640 GOSUB PLAY
 650 GOTO 620
 990 REM -----
1000 REM ■ TITLE
1010 PRINT "[illegible]"
1020 PRINT "[illegible]"
1030 PRINT "[illegible]"
1040 PRINT "[illegible]"
1050 PRINT AT 23,3;"  BY P.DZIWI
OR, MAY 1983 "
1060 FOR K=1 TO 75
```

```
1070 IF INKEY$>"" THEN RETURN
1080 NEXT K
1090 PRINT AT 23,3;"PRESS ANY KEY TO CONTINUE"
1100 FOR K=1 TO 75
1110 IF INKEY$>"" THEN RETURN
1120 NEXT K
1130 GOTO 1050
1990 REM -----
2000 REM ■ INSTRUCTIONS
2010 GOSUB BORDER
2020 PRINT AT 2,4;"IT IS THE DAY BEFORE THE";TAB 4;"SINCLAIR GRAND PRIX; IN";TAB 2;"TODAYS LAP TIMINGS YOU WILL";TAB 4;"HAVE TO STEER YOUR HIGH"
2030 PRINT TAB 3;"SPEED, FIVE-GEAR, FORMULA";TAB 3;"ONE CAR AROUND THE CIRCUIT";TAB 5;"IN AS SHORT A TIME AS";TAB 12;"POSSIBLE."
2040 PRINT AT 11,2;"EACH LAP IS ";L$;" UNITS LONG.";TAB 3;"IF YOU HIT THE EDGE OF THE";TAB 2;"TRACK YOU WILL INCUR A THREE";TAB 9;"SECOND PENALTY."
2050 PRINT TAB 2;"STEER THE CAR LEFT/RIGHT BY";TAB 8;"PRESSING """9""/""0""".";TAB 3;"CHANGE UP/DOWN ONE GEAR BY";TAB 5;"PRESSING ""E""/""D"" ONCE."
2060 PRINT AT 20,3;"PLEASE WAIT WHILE I DESIGN";TAB 9;"THE RACE TRACK."
2070 GOSUB TRACK
2100 PRINT AT 20,3;"      **TRACK READY**      ";TAB 5;"PRESS ANY KEY TO START"
2110 PRINT AT 20,8;"**";TAB 21;"**"
2120 FOR K=1 TO 10
2130 IF INKEY$>"" THEN RETURN
2140 NEXT K
2150 PRINT AT 20,8;"  ";TAB 21;"  "
2160 FOR K=1 TO 10
2170 IF INKEY$>"" THEN RETURN
2180 NEXT K
2190 GOTO 2110
2990 REM -----
3000 REM ■ PLAY
3010 CLS
3020 FOR K=1 TO 22
3030 PRINT "▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒████████▒▒▒▒▒▒▒▒▒▒▒▒▒▒"
3040 NEXT K
3050 PRINT AT 23,0;"TIME=0:00.0   GEAR=0    DIST=000"
3060 PRINT AT 16,1;"COUNTDOWN:▒▚▚▚▚▚▚▚▚▚"
3070 POKE 16451,LENL
3080 POKE 16452,LENH
3090 POKE 16449,15
3100 POKE 16448,1
3110 RAND USR 16987
3120 FOR K=0 TO 9
3130 PRINT AT 16,22;"TEN▒▒NINE▒EIGHTSEVENSIX▒▒FIVE▒FOUR▒THREETWO▒▒ONE▒▒"(5*K+1 TO 5*K+5)
3140 FOR J=1 TO 19
3150 NEXT J
3160 NEXT K
3200 PRINT AT 16,22;"**GO**"
3210 RAND USR 16538
3220 FOR K=1 TO 6
3230 PRINT AT 23,4+K;
3240 LET T$(K)=CHR$ PEEK (PEEK 16398+256*PEEK 16399)
3250 NEXT K
3300 LET SPEED=INT (VAL L$*9/(VAL T$(1)*60+VAL T$(3 TO 6)))
3510 LET C$="SLOW"
3520 IF SPEED>=70 THEN LET C$="POOR"
3530 IF SPEED>=85 THEN LET C$="FAIR"
3540 IF SPEED>=100 THEN LET C$="FAST"
3990 REM -----
4000 REM ■ DISPLAY TIMES
4010 GOSUB BORDER
4020 PRINT AT 2,2;"LAP: ";LAP;TAB 2;"YOUR TIME WAS ";T$(1);" MIN ";T$(3 TO 6);" SEC"
4030 PRINT TAB 2;"AVERAGE SPEED WAS ";SPEED;" MPH";TAB 2;"THIS IS RATED AS ";C$;"."
4040 IF T$<W$ AND LAP>1 THEN GOTO 4080
4050 LET W$=T$
4060 LET WSTLAP=LAP
4070 IF LAP>2 THEN PRINT AT 6,2;"--SLOWEST TIME YET--"
4080 IF T$>B$ AND LAP>1 THEN GOTO 4120
4090 LET B$=T$
4100 LET BSTLAP=LAP
4110 IF LAP>2 THEN PRINT AT 6,2;"**FASTEST LAP SO FAR**"
4120 PRINT AT 8,2;" BEST TIME=";B$;" (LAP ";BSTLAP;")"
4130 PRINT AT 9,2;"WORST TIME=";W$;" (LAP ";WSTLAP;")"
4140 FOR K=1 TO 6
4150 LET X$(K)=X$(K+1)
4160 NEXT K
4170 LET X$(7,1 TO 6)=T$
4180 LET X$(7,9 TO 11)=STR$ SPEED
4190 LET X$(7,14 TO 17)=C$
4200 PRINT
4210 FOR K=1 TO 7
4220 IF X$(K,1)>" " THEN PRINT TAB 3;"LAP ";FSTLAP+K;":";TAB 11;X$(K)
4230 NEXT K
4300 LET FSTLAP=FSTLAP+1
4310 LET LAP=LAP+1
4500 PRINT AT 19,2;"PRESS A FOR ANOTHER LAP OF";TAB 4;"THE SAME CIRCUIT.";TAB 2;"PRESS N FOR A NEW CIRCUIT."
4510 IF INKEY$="A" THEN GOTO PLAY
4520 IF INKEY$="N" THEN RETURN
4530 GOTO 4510
4990 REM -----
5000 REM ■ BORDER
5010 CLS
5020 PRINT "▚▚▚▚▚▚▚▚▚▚FORMULA▚ONE▚▚▚▚▚▚▚▚▚▚";
5030 FOR K=1 TO 22
5040 PRINT TAB 31;"▚▚";
5050 NEXT K
5060 PRINT "▚▚▚▚▚▚▚▚▚▚FORMULA▚ONE▚▚▚▚▚▚▚▚▚▚";
5070 RETURN
5990 REM -----
6000 REM ■ TRACK
6010 RAND
6060 POKE 16444,0
6070 POKE 16445,LENL
6080 POKE 16446,LENH
6090 POKE 16447,1
```

```
6100 POKE 16448,12
6110 POKE 16449,INT (RND*128)
6120 IF USR 17110 THEN GOTO 6110

6200 DIM X$(7,17)
6210 LET LAP=1
6220 LET W$=""
6230 LET WSTLAP=0
6240 LET B$=""
6250 LET BSTLAP=0
6260 LET FSTLAP=-6
6270 RETURN
6990 REM -----
7000 SAVE "FORMULA ON▣"
7010 RUN
9000 POKE 16511,220
9010 POKE 16512,2
9020 FOR K=0 TO 91
9030 SCROLL
9040 PRINT CHR$ (51+INT (K/10));
CHR$ (28+10*(K/10-INT (K/10)));"
)";
9050 LET TOT=0
9060 FOR J=0 TO 7
9070 INPUT I$
9080 IF I$="X" THEN LET K=K-1
9090 IF I$="X" THEN GOTO 9030
9100 IF LEN I$<>2 THEN GOTO 9070

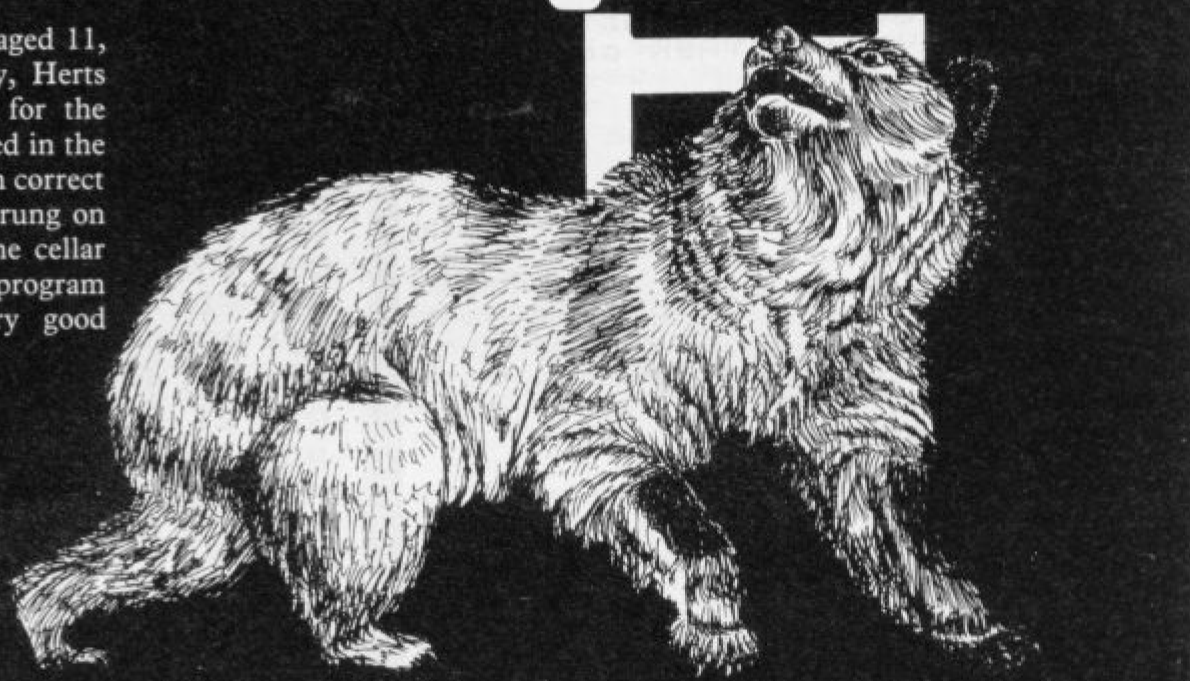
9110 PRINT " ";I$;
9120 LET N=16*(CODE I$-28)+(CODE
I$(2)-28)
9130 POKE 16514+8*K+J,N
9140 LET TOT=TOT+N
9150 NEXT J
9160 PRINT "=";TOT
9170 NEXT K
```

Hexadecimal listing

```
gNO) 97 00 35 1B 29 3F 2E 3C=128
N1) 2E 34 37 1A 00 32 26 3E=128
N2) 00 1D 25 24 1F 76 FF FF=128
N3) FD 7E 34 FD 77 3C FD 36=128
N4) 3D 05 FD 36 3E 00 FD 36=128
N5) 3F 06 FD 36 42 06 2A 0C=128
N6) 40 01 0C 03 09 36 1C FD=128
N7) 7E 3C FD BE 34 28 FB FD=128
N8) 35 3C CD 46 0F D0 FD 35=128
N9) 3D 20 29 FD 36 3D 05 2A=128
O0) 0C 40 01 02 03 09 34 7E=128
O1) FE 26 38 18 36 1C 2B 2B=128
O2) 34 7E FE 26 38 0E 36 1C=128
O3) 2B 34 7E FE 22 38 05 36=128
O4) 1C 2B 2B 34 CD 30 42 CD=128
O5) 5B 42 FD 7E 3E A7 28 2D=128
O6) FD CB 42 BE CB 47 C4 30=128
O7) 42 FD 35 3E 20 A9 2A 0C=128
O8) 40 01 31 02 09 06 00 FD=128
O9) 4E 41 09 79 C6 02 CB 7E=128
P0) 28 02 D6 04 FD 77 41 CD=128
P1) 5B 42 C3 B0 40 21 45 40=128
P2) 06 07 CB 7E 20 06 FD 36=128
P3) 3E 97 18 B8 23 10 F3 FD=128
P4) 35 3F 20 1F FD 36 3F 08=128
P5) 3E EF DB FE 2F E6 03 28=128
P6) 12 CD 30 42 1F 30 03 FD=128
P7) 34 41 1F 30 03 FD 35 41=128
P8) CD 5B 42 FD 7E 42 E6 80=128
P9) 4F 3E FB DB FE E6 04 1F=128
Q0) B1 4F 3E FD DB FE E6 04=128
Q1) B1 4F 2F FD A6 42 57 FD=128
Q2) 71 42 2A 0C 40 01 0C 03=128
Q3) 09 7E CB 52 28 05 FE 1D=128
Q4) 38 01 35 CB 4A 28 05 FE=128
Q5) 21 30 01 34 7E FE 1D 30=128
Q6) 0B FD CB 42 BE FD 36 40=128
Q7) 01 C3 B9 40 FD 35 40 C2=128
Q8) B9 40 2F C6 24 FD 77 40=128
Q9) FD 7E 42 EE 80 FD 77 42=128
R0) 17 DA B9 40 CD 30 42 2A=128
R1) 0C 40 01 B5 02 09 E5 01=128
R2) 21 00 09 54 5D E1 01 B6=128
R3) 02 ED B8 CD 5B 42 FD 7E=128
R4) 45 FE 86 C8 0E 80 ED 5B=128
R5) 43 40 7A B3 28 0B 1B ED=128
R6) 53 43 40 7A B3 20 02 0E=128
R7) 86 2A 7B 40 19 54 5D 2A=128
R8) 0C 40 1A 1F 1F 1F E6 1F=128
R9) 47 23 36 08 10 FB 1A E6=128
S0) 07 C6 08 47 23 71 10 FC=128
S1) 23 36 08 2A 0C 40 01 17=128
S2) 03 09 3E 25 34 BE D2 B9=128
S3) 40 36 1C 2B 18 F6 2A 0C=128
S4) 40 01 11 02 09 06 00 FD=128
S5) 4E 41 09 54 5D 21 45 40=128
S6) 01 03 00 ED B0 EB 01 1F=128
S7) 00 09 EB ED A0 EB 01 1F=128
S8) 00 09 EB 01 03 00 ED B0=128
S9) C9 2A 0C 40 01 11 02 09=128
T0) 06 00 FD 4E 41 09 11 45=128
T1) 40 FD CB 42 7E ED A0 2B=128
T2) 36 05 28 02 36 80 23 ED=128
T3) A0 2B 36 16 23 ED A0 2B=128
T4) 36 85 28 02 36 80 01 20=128
T5) 00 09 ED A0 2B 36 34 01=128
T6) 20 00 09 ED A0 2B 36 05=128
T7) 28 02 36 80 23 ED A0 2B=128
T8) 36 09 23 ED A0 2B 36 85=128
T9) 28 02 36 80 C9 00 00 00=128
U0) 00 00 00 00 00 00 00 00=128
U1) 00 00 00 17 17 35 1B 29=128
U2) 3F 2E 3C 2E 34 37 17 17=128
U3) 00 00 00 00 00 00 00 00=128
U4) 00 00 00 00 3A 3C 40 EE=128
U5) 80 32 3C 40 FD 4E 41 79=128
U6) E6 0F 3C 47 ED 5B 3F 40=128
U7) FD CB 3C 7E 20 07 15 CB=128
U8) 71 20 02 14 14 CD 25 43=128
U9) CB 69 20 03 CD 25 43 10=128
V0) E7 05 FD CB 3C 7E C0 CB=128
V1) 61 20 08 1C CB 71 28 09=128
V2) 15 18 06 1D CB 71 20 01=128
V3) 14 CD 25 43 C9 C1 FD CB=128
V4) 3C FE C9 7B FE 05 30 F5=128
V5) 82 FE 18 30 F0 7A A7 28=128
V6) EC ED 53 3F 40 17 17 17=128
V7) B3 ED 5B 3D 40 1B ED 53=128
V8) 3D 40 2A 7B 40 19 77 21=128
V9) 10 00 1B ED 52 ED 5B 3F=128
W0) 40 D8 20 E5 C1 01 00 00=128
W1) 18 DF 76 00 64 02 00 E4=128
```

INFANT IQ TEST

BARRY RAWLINSON, aged 11, of Welwyn Garden City, Herts wrote **Infant IQ Test** for the 48K Spectrum. Teddy is trapped in the cellar and wants to get out. Each correct answer will let him climb one rung on the ladder until he is out of the cellar and in the garden. It is a good program for young children with very good graphics.



```
   1 REM INFANT IQ
   3 LET sc=0: LET q=1: LET wr=0
  FOR a=USR "a" TO USR "t"+7: RE
AD user: POKE a,user: NEXT a
   4 DATA 1,3,7,15,31,63,127,255
,128,192,224,240,248,252,254,255
,0,0,60,126,126,60,0,0
   5 DATA 255,255,193,193,193,19
3,193,255,255,255,131,131,131,13
1,131,255,255,193,193,193,193,19
3,255,255,255,131,131,131,131,13
1,255,255
   6 DATA 255,0,255,0,255,0,255,
0
   7 DATA 0,0,1,3,3,1,0,0,0,0,15
3,255,255,219,231,231,0,0,128,19
2,192,128,0,0,0,0,0,0,1,3,15,31,
255,126,255,255,255,255,255,255,
0,0,0,0,128,192,240,248
   8 DATA 63,127,127,255,251,243
,227,1,255,255,255,255,255,255,2
55,255,252,254,254,255,223,207,1
99,128
   9 DATA 3,7,15,15,31,31,63,60,
231,231,195,195,195,129,0,0,192,
224,224,240,240,248,252,60
  10 BORDER 5: PAPER 5: INK 4: C
LS
  20 FOR f=17 TO 21: PRINT AT f,
0;"(32*198)": NEXT f
  30 LET q$="(a:8*198:b)": LET w
$="(a:10*198:b)"
  40 DIM a$(6,10): LET a$(1)="(1
0*198)": LET a$(2)="(3*198:195:2
*sP:95:3*198)": LET a$(3)="(198:
2*sP:195:2*sP:95:2*sP:198)": LET
 a$(4)="(198:2*sP:195:2*sP:95:2*
sP:198)": LET a$(5)="(3*198:195:
2*sP:95:3*198)": LET a$(6)="(3*1
98:195:2*sP:95:3*198)"

  50 INK 7: FOR f=1 TO 6: PRINT
AT f+10,18;a$(f): NEXT f
  60 INK 2: PRINT AT 9,18;q$;AT
10,17;w$
  70 FOR f=1 TO 5: PRINT AT f+11
,21; INK 1; PAPER 7;"(95:2*198:1
95)": NEXT f
  90 PRINT AT 14,22; INK 7; PAPE
R 1;"c"
 140 PRINT AT 13,19; INK 2;"de"
 150 PRINT AT 14,19; INK 2;"fg";
AT 13,25; INK 2;"de"
 160 PRINT AT 14,25; INK 2;"fg"
 190 FOR f=14 TO 16: PRINT AT f,
5; INK 2; PAPER 0; BRIGHT 1;"hh"
: NEXT f
 195 DIM t$(12,6)
 200 LET t$(1)="(2*sP:95:3*sP)":
 LET t$(2)="(2*sP:95:3*sP)": LET
 t$(3)="(2*sP:198:195:2*sP)": LE
T t$(4)="(2*sP:198:195:2*sP)": L
ET t$(5)="(sP:95:2*198:2*sP)": L
ET t$(6)="(sP:95:2*198:2*sP)": L
ET t$(7)="(sP:3*198:195:sP)": LE
T t$(8)="(sP:3*198:195:sP)": LET
 t$(9)="(95:4*198:sP)": LET t$(1
0)="(95:4*198:sP)": LET t$(11)="
(5*198:195)": LET t$(12)="(5*198
:195)"
 210 FOR f=1 TO 12: PRINT AT f+1
,3; INK 4;t$(f): NEXT f
 220 PRINT AT 8,25; INK 0;"(198)
"
 230 FOR f=10 TO 0 STEP -1: CIRC
LE  INK 6;210,150,f
 240 NEXT f
 300 REM QUESTIONS
 330 IF q=1 THEN  GO TO 500
 340 IF q=2 THEN  GO TO 1000
 350 IF q=3 THEN  GO TO 1500
 360 IF q=4 THEN  GO TO 2000
 370 IF q=5 THEN  GO TO 2500
 380 IF q=6 THEN  GO TO 3000
 390 IF q=7 THEN  GO TO 3500
 400 IF q=8 THEN  GO TO 4000
 410 IF q=9 THEN  GO TO 4500
 420 IF q=10 THEN  GO TO 5000
 430 IF q=11 THEN  GO TO 7000
 500 REM QUESTION 1
 510 LET q=q+1
 520 INPUT "WHAT COLOUR IS THE D
OOR ? "; LINE q$
 530 IF q$="BLUE" OR q$="blue" O
R q$="Blue" THEN  GO TO 580
 540 GO SUB 5500
 550 GO TO 520
 580 LET sc=sc+1
 590 GO TO 6000
1000 REM QUESTION 2
1010 LET q=q+1
1020 INPUT "HOW MANY WINDOWS ARE
 THERE ? "; LINE q$
1030 IF q$="2" OR q$="two" OR q$
="TWO" OR q$="Two" THEN  GO TO 1
080
1040 GO SUB 5500
1050 GO TO 1020
1080 LET sc=sc+1
1090 GO TO 6000
1500 REM QUESTION 3
1510 LET q=q+1
1520 INPUT "WHAT COLOUR IS THE T
REE ? "; LINE q$
1530 IF q$="GREEN" OR q$="green"
 OR q$="Green" THEN  GO TO 1580
1540 GO SUB 5500
1550 GO TO 1520
1580 LET sc=sc+1
1590 GO TO 6000
2000 REM QUESTION 4
2010 LET q=q+1
2020 INPUT "BONUS QUESTION - WHA
T IS 2+3 ? "; LINE q$
2030 IF q$="5" OR q$="FIVE" OR q
$="five" OR q$="Five" THEN  GO T
O 2080
2040 GO SUB 5500
2050 GO TO 2020
2080 LET sc=sc+1
2090 GO TO 6000
2500 REM QUESTION 5
2510 LET q=q+1
2520 INPUT "WHAT COLOUR IS THE H
OUSE ? "; LINE q$
2530 IF q$="WHITE" OR q$="white"
 OR q$="White" THEN  GO TO 2580
2540 GO SUB 5500
2550 GO TO 2520
2580 LET sc=sc+1
2590 GO TO 6000
3000 REM QUESTION 6
3010 LET q=q+1
3020 INPUT "WHAT COLOUR IS THE S
UN ? "; LINE q$
3030 IF q$="YELLOW" OR q$="yello
w" OR q$="Yellow" THEN  GO TO 30
80
3040 GO SUB 5500
3050 GO TO 3020
3080 LET sc=sc+1
3090 GO TO 6000
3305 FOR g=1 TO 4: PRINT AT f+g-
1,3; INK 6;n$(g): NEXT g
3500 REM QUESTION 7
3510 LET q=q+1
3520 INPUT "BONUS QUESTION - WHA
T IS 3-1 ? "; LINE q$
3530 IF q$="2" OR q$="TWO" OR q$
="two" OR q$="Two" THEN  GO TO 3
580
3540 GO SUB 5500
3550 GO TO 3520
3580 LET sc=sc+1
3590 GO TO 6000
4000 REM QUESTION 8
4010 LET q=q+1
4020 INPUT "WHAT COLOUR IS THE R
OOF ? "; LINE q$
4030 IF q$="RED" OR q$="red" OR
q$="Red" THEN  GO TO 4080
```

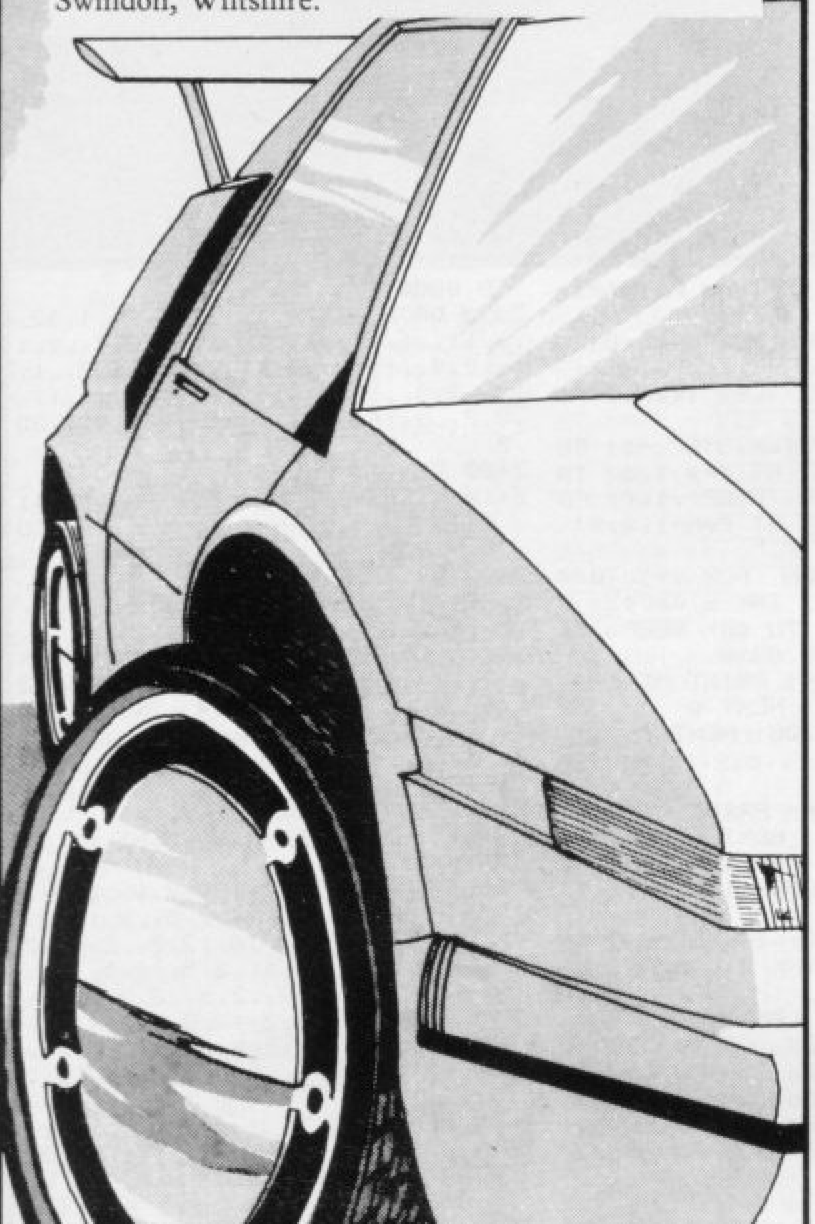


```
4040 GO SUB 5500
4050 GO TO 4020
4080 LET sc=sc+1
4090 GO TO 6000
4500 REM QUESTION 9
4510 LET q=q+1
4520 INPUT "WHAT COLOUR IS THE C
HIMNEY ? "; LINE g$
4530 IF g$="BLACK" OR g$="Black"
 OR g$="black" THEN  GO TO 4580
4540 GO SUB 5500
4550 GO TO 4520
4580 LET sc=sc+1
4590 GO TO 6000
5000 REM QUESTION 10
5010 LET q=q+1
5020 INPUT "BONUS QUESTION - WHA
T IS 4+2 ? "; LINE g$
5030 IF g$="6" OR g$="SIX" OR g$
="six" OR g$="Six" THEN  GO TO 5
080
5040 GO SUB 5500
5050 GO TO 5020
5080 LET sc=sc+1
5090 GO TO 6000
5500 REM WRONG ANSWER
5501 LET wr=wr+1
5510 PRINT £1;AT 0,0; INK 0;"Oh
Dear !                        Tha
t's wrong - Try again"
5520 RESTORE 5530: FOR f=1 TO 36
: READ a,b: BEEP a/3,b: NEXT f:
RETURN
5530 DATA .5,0,.5,2,.25,3,.25,2,
.5,0,.5,0,.5,2,.25,3,.25,2,.5,0,
.5,3,.5,5,1,7,.5,3,.5,5,1,7,.375
,7,.125,8,.25,7,.25,5,.25,3,.25,
2,.5,0,.375,7,.125,8,.25,7,.25,5
,.25,3,.25,2,.5,0,.5,0,.5,-5,1,0
,.5,0,.5,-5,1,0
6000 REM REWARD
6010 BORDER 1: PAPER 1: INK 6: C
LS
6020 DIM m$(22,3)
6030 LET m$(1)="(191:193:192)"
6040 FOR f=2 TO 21: LET m$(f)=m$
(1): NEXT f
6045 LET m$(22)="(92:sP:92)"
6050 FOR f=1 TO 22: PRINT  INK 7
;m$(f): NEXT f
6060 DIM n$(5,3)
6070 LET n$(1)="ijk"
6080 LET n$(2)="lmn"
6090 LET n$(3)="opq"
6100 LET n$(4)="rst"
6110 PRINT  FLASH 1;AT 2,15;"COR
RECT"
6120 PRINT AT 4,15;"How high can
";AT 5,15;"Teddy climb ?"
6140 IF sc=10 THEN  LET qwe=0: G
O TO 6300
6150 LET poi=sc*2: LET lkj=19-po
i: LET qwe=lkj
6300 FOR f=18 TO qwe STEP -1: FO
R g=1 TO 4: PRINT AT f+g-1,3; IN
K 6;n$(g): NEXT g: BEEP .1,f: FO
R h=1 TO 4: PRINT AT f+h-1,3;"
 ": NEXT h: NEXT f
6301 IF sc=10 THEN  FOR g=1 TO 4
: PRINT AT g-1,3; INK 6;n$(g): N
EXT g: FOR f=-60 TO 60: BEEP .01
,f: NEXT f: GO TO 6310
6305 FOR g=1 TO 4: PRINT AT f+g-
1,3; INK 6;n$(g): NEXT g
6310 FOR f=1 TO 200: NEXT f
6320 GO TO 10
7000 REM FINISH
7010 FOR f=1 TO 4: PRINT AT f+12
,13; INK 6;n$(f): NEXT f: PRINT
AT 3,8; FLASH 1; INK 1;"TEDDY CL
IMBED";AT 4,8; FLASH 1; INK 1;"
THE  LADDER "
7020 PRINT AT 6,8; INK 2;"YOU HA
VE AN ";AT 7,8; INK 2;"INFANT IQ
 OF ";100-wr
7100 LET tyr=INT (RND*5)+1
7110 IF tyr=1 THEN  GO TO 7200
7120 IF tyr=2 THEN  GO TO 7300
7130 IF tyr=3 THEN  GO TO 7400
7140 IF tyr=4 THEN  GO TO 7500
7150 IF tyr=5 THEN  GO TO 7600
7155 GO TO 7100
7200 REM TUNE 1
7210 RESTORE 7220: FOR f=1 TO 81
: READ a,b: BEEP a,b: NEXT f: GO
 TO 8000
7220 DATA .2,10,.2,10,.2,10,.2,7
,.2,10,.2,12,.2,10,.4,7,.2,7,.4,
5,.2,7,.4,5,.2,10,.2,10,.2,10,.2
,7,.2,10,.2,12,.2,10,.4,7,.2,7,.
2,5,.2,7,.2,5,.4,3,.2,10,.2,10,.
2,10,.2,7,.1,10,.1,10,.2,12,.2,1
0,.4,7,.2,7,.4,5,.2,7,.4,5,.2,10
,.2,10,.2,10,.2,7,.1,10,.1,10,.1
,12,.1,12,.1,10,.1,10,.4,7,.2,7,
.2,5,.2,7,.2,5,.8,3,.2,3,.1,3,.2
,7,.2,10,.8,15,.2,12,.1,12,.2,15
,.2,12,.4,10,.2,7,.2,10,.2,10,.1
,7,.1,7,.1,10,.1,10,.2,12,.2,10,
.4,7,.2,5,.1,7,.1,8,.2,7,.1,5,.1
,5,.8,3
7300 REM TUNE 2
7310 RESTORE 7320: FOR f=1 TO 27
: READ a,b: BEEP a,b: NEXT f: GO
 TO 8000
7320 DATA .2,7,.1,11,.2,9,.1,12,
.1,11,.1,14,.1,11,.2,7,.2,7,.1,1
1,.2,9,.1,12,.3,11,.3,7,.2,7,.1,
11,.2,9,.1,12,.1,11,.1,14,.1,11,
.2,7,.3,16,.2,9,.1,12,.25,11,.25
,7
7400 REM TUNE 3
7410 RESTORE 7420: FOR f=1 TO 41
: READ a,b: BEEP a,b: NEXT f: GO
 TO 8000
7420 DATA .6,9,.2,9,.2,10,.2,9,.
2,7,1,5,.6,14,.2,14,.2,10,.2,12,
.2,14,1,12,.2,12,.2,14,.2,14,.2,
14,.2,10,.2,12,.2,14,.2,12,.2,14
,.2,12,.4,9,.2,12,.2,14,.2,14,.2
,14,.2,10,.2,12,.2,14,.2,12,.2,1
4,.2,12,.4,9,.2,10,.4,12,.2,12,.
2,10,.2,9,.2,7,.8,5
7500 REM TUNE 4
7510 RESTORE 7520: FOR f=1 TO 49
: READ a,b: BEEP a,b: NEXT f: GO
 TO 8000
7520 DATA .6,8,.2,10,.2,8,.2,5,.
2,3,.2,1,.2,3,.2,1,.2,5,.2,1,.2,
-2,.8,-4,.6,8,.2,10,.2,8,.2,5,.2
,3,.2,1,.2,5,.2,1,.2,5,.2,5,.8,3
,.6,8,.2,10,.2,8,.2,5,.2,3,.2,1,
.2,3,.2,1,.2,5,.2,1,.2,-2,.4,-4,
.2,1,.2,3,.2,1,.2,5,.2,1,.2,-2,.
2,-4,.2,-2,.2,1,.2,5,.2,1,.2,5,.
2,5,.2,1
7600 REM TUNE 5
7610 RESTORE 7620: FOR f=1 TO 30
: READ a,b: BEEP a,b: NEXT f: GO
 TO 8000
7620 DATA .1,0,.1,5,.2,5,.3,5,.1
,5,.2,4,.2,7,.4,7,.1,0,.1,7,.2,7
,.3,7,.1,7,.2,5,.2,9,.4,9,.1,5,.
1,9,.2,9,.3,9,.1,9,.2,10,.2,14,.
4,14,.1,14,.2,12,.2,12,.2,10,.2,
4,.6,5
8000 LET g$="Press Any"
8005 LET x$="Key To"
8010 LET u$="Restart"
8020 BORDER 0: PAPER 0: INK 7: C
LS
8030 PRINT AT 1,0;g$;AT 5,0;x$;A
T 9,0;u$
8040 PAUSE 0
8050 RUN
9100 SAVE "INFANT IQ" LINE 1
9110 PRINT AT 0,0;"REWIND TAPE A
ND VERIFY"
9120 VERIFY "INFANT IQ"
9130 STOP
```

MOTORIST MATHS

MOTORIST MATHS is a simple but graphical program for the 16K ZX-81. The aim of the game, which is suitable for young children, is to answer all the questions correctly to be saved from the motorist. You need a minimum of six sums correct to guarantee your safety.

Motorist Maths was written by Roger Fox of Swindon, Wiltshire.



```
   2 LET W=0
   3 LET S=0
  10 PRINT AT 10,10;"ANY KEY"
  20 PRINT AT 10,10;"ANY KEY"
  30 IF INKEY$<>"" THEN GOTO 45
  40 GOTO 10
  45 CLS
  50 PRINT "INSTRUCTIONS?(Y/N)"
  60 INPUT A$
  70 IF A$="Y" THEN GOTO 105
  80 IF A$="N" THEN GOTO 118
 100 IF A$<>"Y" OR A$<>"N" THEN
GOTO 60
 105 CLS
 110 PRINT "YOU HAVE BEEN CAPTUR
ED BY THE     MAD MOTORIST.HE HAS
SET YOU A     TEST, IF YOU SUCSEED
 IN PASSING    YOU BLOW UP THE MA
D MOTORIST. BUT IF YOU FAIL YOU
WILL BE       KILLED...."
 113 PRINT "ANY KEY"
 115 PAUSE 4E4
 118 CLS
 120 FOR N=1 TO 31
 130 PRINT AT 17,N;"▒"
 140 NEXT N
 150 PRINT AT 16,9;"▙ ▙ ";AT 15,
9;"▛▀▜";AT 14,8;"▌███▐";AT 13,8;
"▛▀▀▜";AT 12,10;"▀";AT 11,9;"▒▒
▒";AT 10,9;"▄▒▄"
 160 PRINT AT 16,24;" O   O";AT
15,24;"▛▀▀▀▀▜";AT 14,24;"██████
█";AT 13,25;"▞ ▌ ▚";AT 12,26;"▬
▬"
 170 FOR T=1 TO 10
 171 LET A=INT (RND*10)+1
 172 LET B=INT (RND*10)+1
 180 PRINT AT 0,6;A;"+";B;"=   "
 190 INPUT C
 200 IF C=A+B THEN PRINT "RIGHT"

 210 IF C=A+B THEN LET S=S+1
 220 IF C<>A+B THEN PRINT "WRONG
"
 230 IF C<>A+B THEN LET W=W+1
 240 IF W=5 THEN GOTO 1000
 250 IF S>5 AND T=10 THEN GOTO 5
00
 260 NEXT T
 500 FOR D=14 TO 24
 510 PRINT AT 12,D;" ."
 520 NEXT D
 540 FOR G=16 TO 11 STEP -1
 550 PRINT AT G,24;"██████"
 560 NEXT G
 570 CLS
 580 PRINT AT 10,1;"YOU HAVE KIL
LED THE MOTORIST...";AT 11,6;"SC
ORE=";S
 590 STOP
1000 FOR C=24 TO 1 STEP -1
1010 PRINT AT 16,C;" O   O ";AT
15,C;"▛▀▀▀▀▜ ";AT 14,C;"███████
 ";AT 13,C+1;"▞ ▌ ▚ ";AT 12,C+2;
"▬▬ "
1015 PRINT AT 10,9;"   ";AT 11,9
;"   "
1020 NEXT C
1030 CLS
1040 PRINT AT 10,6;"YOU ARE DEAD
...";AT 11,6;"SCORE=";S
```

BATTLE 1917

BATTLE 1917 was written for the 48K Spectrum by Mark Lucas and was the winner of the 1983 Cambridge Award. The cassette version is published by CCS.

It is a game with moves which often require as much forethought and calculation as the moves in a game of chess. Each player has 29 movable pieces comprising tanks, artillery, cavalry and infantry and the object of the game is to kill the opponent's weakest piece, the King. There is a compass on-screen to aid the movement of pieces and each piece has a certain number of spaces it can move, as do the pieces in a chess game.

The pieces manoeuvre across a battlefield featuring lakes, forests, minefields and barbed wire. It is advisable to keep units of four pieces together in formation, rather than leaving some behind.

To type in the program first enter the instructions and SAVE them. Then type in the main listing and once that has been SAVED the program is ready to be used.

```
6   5 CLEAR 64340
  10 RESTORE 6000
  20 FOR x=65368 TO 65455
  30 READ n
  40 POKE x,n
  50 NEXT x
  60 PRINT  AT 1,4; BRIGHT 1;"BA
TTLE 1917"; BRIGHT 0
  65 PRINT  AT 2,4; BRIGHT 1;"@
Mark Lucas 1983"; BRIGHT 0
  70 PRINT  AT 20,0; INK 2; PAPE
R 6; FLASH 1; BRIGHT 1;"STOP TAP
E NOW,  PROGRAM RUNNING "; FLASH
 0; BRIGHT 0; INK 0; PAPER 7
  80 BEEP 2,10: BEEP 2,-10
  90 GO TO 8000
 100 CLS : PRINT  AT 1,4; BRIGHT
 1;"BATTLE 1917"; BRIGHT 0
 110 PRINT  AT 3,4; BRIGHT 1;"He
re are your armies..."; BRIGHT 0
 120 PRINT  AT 5,13;"How  Fight
"; INK 1; PAPER 5;"II"; INK 4;
PAPER 7;" HH"
 130 PRINT  AT 6,13;"Far? Value?
"; INK 1; PAPER 5;"II"; INK 0;
PAPER 7;"  JJ"
 200 RESTORE 7000
 210 FOR n=8 TO 12
 220 READ a$,q$,w$,s$,f$,e$
 230 PRINT  AT 15,0;a$;q$;" ";w$
 235 BEEP 2,0
 240 PRINT  AT 16,4;"moving at u
pto ";s$;" spaces"
 245 BEEP 2,5
 250 PRINT  AT 17,4;"fighting wi
th an extra + ";f$
 255 BEEP 2,10
 260 PRINT  AT 18,4;"  cannot cr
oss  lakes "; INK 1; PAPER 5;"I
IIII"
 265 BEEP 2,15
 270 PRINT  AT 19,4;"  cannot cr
oss forests "; INK 4;"HHHHH"
```



```
 272 PRINT  AT 20,4;"  cannot cr
oss    wire ";"JJJJJ"
 275 IF n=10 THEN  GO TO 1000
 280 IF n=11 THEN  GO TO 1100
 285 IF n=12 THEN  GO TO 1300
 290 BEEP 4,20
 300 FOR l=14 TO n STEP -1
 305 PRINT  AT l+1,0;"     "
 310 PRINT  AT l,0;a$
 315 BEEP .15,1
 330 NEXT l
 410 PRINT  AT n,4;w$
 500 PRINT  AT n,15;s$;"    +";f
$;"  no  ";e$
 510 FOR a=15 TO 21
 520 PRINT  AT a,0;"
"
 530 NEXT a
 900 NEXT n
 950 GO TO 2000
 999 STOP
1000 PRINT  AT 19,4; BRIGHT 1;"
    flatten  forests "; BRIGHT
0
1010 PRINT  AT 20,4; BRIGHT 1;"
    flatten    wire "; BRIGHT
0: BEEP 4,-20
1020 FOR l=16 TO 20: PRINT  AT l
,0;a$: PRINT  AT l-1,0;"    ": B
EEP .1,-20: NEXT l
1025 PRINT  AT 21,4; FLASH 1; IN
K 1; PAPER 6; BRIGHT 1;"LOOK OUT
 !"; FLASH 0; INK 0; PAPER 7; BR
IGHT 0
1030 FOR t=0 TO 28: PRINT  AT 20
,t;" ";a$: BEEP .1,-20: NEXT t
1040 PRINT  AT 19,29;a$: PRINT
AT 20,29;"    ": BEEP .1,-20
1045 PRINT  AT 21,0; FLASH 1; IN
K 1; PAPER 6; BRIGHT 1;"TANKS, G
O BACK TO YOUR PLACES !"; FLASH
0; INK 0; PAPER 7; BRIGHT 0
1050 FOR t=28 TO 0 STEP -1: PRIN
T  AT 19,t;a$;" ": BEEP .1,-20:
NEXT t
1060 FOR l=18 TO 15 STEP -1: PRI
NT  AT l+1,0;"    ": PRINT  AT l
,0;a$: BEEP .1,1: NEXT l
1080 GO TO 300
1100 PRINT  AT 20,4;"but "; BRIG
HT 1;" fire  at other pieces !";
 BRIGHT 0: BEEP 4,-20
1110 LET c=15: FOR a=8 TO 10: LE
T b=7: GO SUB 1119
1115 GO TO 1200
1119 PRINT AT c,0; FLASH 1; BRI
GHT 1;"E"; BRIGHT 0; FLASH 0;" "
; INK 2; FLASH 1; BRIGHT 1;"E"

1120 BEEP .5,-30
1130 PRINT  AT a,b; FLASH 1; BRI
GHT 1; INK 2; PAPER 6;"*"
1140 PRINT  AT a,b+2; FLASH 1; B
RIGHT 1; INK 2; PAPER 6;"*"
1180 NEXT a
1190 RETURN
1200 PRINT  AT 21,4; FLASH 1; BR
IGHT 1; INK 1; PAPER 6;"STOP THA
T !"; FLASH 0; BRIGHT 0; INK 0;
PAPER 7
1210 FOR a=19 TO 21: GO SUB 1119
1220 PRINT  AT 21,20; INK 1; PAP
ER 6; FLASH 1; BRIGHT 1;"TANKS,
HELP!"; PAPER 7; INK 0; FLASH 0;
 BRIGHT 0
1225 BEEP 2,20
1240 FOR l=10 TO 13: PRINT  AT l
,0;"    ": PRINT  AT l+1,0;"C C
": BEEP .3,-20: NEXT l
1250 BEEP 2,-30
1260 PRINT  AT 21,4; FLASH 1; BR
IGHT 1; INK 1; PAPER 6;"THANKS,
TANKS !         "
1270 FOR l=13 TO 10 STEP -1: PRI
NT  AT l+2,0;"    ": PRINT  AT l
+1,0;"    ": PRINT  AT l,0;"C C
": PRINT  AT l+1,0;"E E ": BEEP
.5,-20: NEXT l
1280 BEEP 2,0
1290 GO TO 410
1300 PRINT  AT 20,0; BRIGHT 1;"
  and you must"; INK 2;" kill "
; INK 0;"the enemy     king to w
in the game !      "
1310 BEEP 4,-30
1320 PRINT  AT 15,0;"      ": PRIN
T  AT 14,1;"F F"
1350 FOR l=13 TO 0 STEP -1: PRIN
T  AT l+1,1;" ": PRINT  AT l,1;"
F": PRINT  AT 14,(16-l);" ": PRI
NT  AT 14,(17-l);"F": BEEP .05,3
0: NEXT l
1360 LET c=11: LET b=16: FOR a=1
0 TO 13: GO SUB 1119
1370 LET b=0: FOR a=0 TO 3: GO S
UB 1119
1380 FOR l=1 TO 14: PRINT  AT 0,
(l*2)-1;" ": PRINT  AT 0,(l*2)+1
;"F": PRINT  AT 15-l,17;" ": PRI
NT  AT 14-l,17;"F": BEEP .05,30:
 NEXT l
1400 GO TO 410
2000 PRINT  AT 15,0;"KKKK minefi
elds !
                       you ca
n usually clear them,     but so
metimes they explode!"
2010 PRINT  AT 0,25;"K": BEEP 4,
0
2020 FOR t=18 TO 25: PRINT  AT 0
,t-1;" ": PRINT  AT 0,t;"F": BEE
P .3,30: NEXT t
2030 PRINT  AT 0,25; FLASH 1; BR
IGHT 1; INK 2; PAPER 6;" ": BEEP
 2,-25
2040 PRINT  AT 19,5; BRIGHT 1;"l
ike that !"; BRIGHT 0
2045 FOR b=0 TO 30 STEP 1: BEEP
.1,b: BEEP .15,10-b: BEEP .1,b-2
0: BORDER  INT (b/4): NEXT b: BO
RDER 7
2050 GO TO 8000
6010 DATA 58,58,18,254,58,56,68,
130
6020 DATA 96,104,82,102,250,248,
136,136
6030 DATA 0,248,254,248,254,254,
186,238
6040 DATA 127,77,32,76,85,67,65,
83
6050 DATA 4,14,28,60,98,234,226,
252
6060 DATA 170,254,254,170,146,18
6,68,56
6070 DATA 166,148,150,168,159,11
5,160,210
6080 DATA 0,16,56,84,186,84,146,
16
6090 DATA 0,96,153,6,0,96,153,6

6100 DATA 2,92,34,102,34,148,79,
48
6110 DATA 0,16,56,124,56,16,0,0

7000 DATA "A A ","8","infantry "
,"5","1","no"
7010 DATA "B B ","8","cavalry  "
,"6","2","no"
7020 DATA "C C ","8","tanks    "
,"3","3","yes"
7030 DATA "E E ","4","artillery"
,"2","0","no"
7040 DATA "F F ","1","king     "
,"2","0","no"
8000 PRINT  AT 21,0; INK 2; PAPE
R 6; FLASH 1; BRIGHT 1;" DO YOU
WANT INSTRUCTIONS ? y/n "; FLASH
 0; BRIGHT 0; INK 0; PAPER 7
8010 POKE 23560,0
8020 LET z= PEEK 23560: IF z=0 T
HEN  GO TO 8020
8030 IF z=121 THEN  GO TO 100
8040 IF z=110 THEN  PRINT  AT 20
,0;"
       ": GO TO 9000
8050 GO TO 8010
9010 PRINT  AT 21,0; FLASH 1; BR
IGHT 1; INK 2; PAPER 6;"     PLE
ASE START TAPE NOW      "; FLASH
0; BRIGHT 0; INK 0; PAPER 7
9888 LOAD "" CODE
9890 LOAD "BATTLE1917"
9900 SAVE "battle1917" LINE 5
```

Main listing

```
   6 PRINT  AT 21,0; FLASH 1; BR
IGHT 1; INK 6; PAPER 2;"STOP TAP
E NOW,  PROGRAM RUNNING "; FLASH
 0; BRIGHT 0; INK 0; PAPER 7
   7 PRINT  AT 21,15; FLASH 1; B
RIGHT 1; INK 6; PAPER 1;" PROGRA
M RUNNING "; FLASH 0; BRIGHT 0;
INK 0; PAPER 7
   8 BEEP 1,10: BEEP 1,-10
  10 FOR x=64341 TO 65012: POKE
x,0: NEXT x
```



```
  20 RESTORE 5000: FOR x=65128 T
O 65143: READ n: POKE x,n: NEXT
x
  22 FOR x=65184 TO 65367: READ
n: POKE x,n: NEXT x
  24 GO SUB 8900
  25 BORDER 7: PAPER 7: INK 1: C
LS
  26 PRINT  AT 21,0; FLASH 1; BR
IGHT 1; INK 6; PAPER 1;" PLEASE
WAIT,   PROGRAM RUNNING "; FLASH
 0; BRIGHT 0; INK 0; PAPER 7
  30 FOR n=65240 TO 65360 STEP 8
: RESTORE 7000: LET m=n/8
  40 FOR x=1 TO  PEEK (m+57053):
 READ g$: NEXT x
  50 FOR i=n TO n+6 STEP 2: IF
PEEK i>20 THEN  GO TO 80
  60 LET la= PEEK i: LET ta= PEE
K (i+1)
  70 POKE (la*32+ta+64341),x-1:
PRINT  AT la,ta;g$: BEEP .02,(la
+ta/2)
  80 NEXT i: NEXT n
 100 FOR x=13 TO 14: RESTORE x*9
: READ g$
 102 RESTORE x*10: FOR y=1 TO 20
 STEP 2: READ l,t
 103 RANDOMIZE
 104 LET ll= INT ( RND *4)+1: LE
T lh= INT ( RND *5)+11: LET tl=
INT ( AND *8)+t: LET th= INT ( R
ND *9)+tl
 106 FOR l=ll TO lh: FOR t=tl TO
 th
 108 POKE (l*32+t+64341),x: PRIN
T  AT l,t;g$: BEEP .01,(l+t)/(x-
11.5)
 110 NEXT t: NEXT l: NEXT y: NEX
T x
 117 DATA "H"
 126 DATA "I"
 130 DATA 2,0,4,2,9,1,11,0,2,16,
3,15,11,14,9,16,8,12,5,11
 140 DATA 2,1,3,0,10,0,11,2,2,16
,4,14,11,16,10,15,6,12,7,13
 200 LET l=1: FOR a=64405 TO 648
84 STEP 32: LET l=l+1
 210 FOR b=a TO (a+30)
 220 IF  PEEK b=14 AND  PEEK (b+
1)=14 AND  PEEK (b+2)=14 AND  PE
EK (b+32)=14 AND  PEEK (b+34)=14
 AND  PEEK (b+64)=14 AND  PEEK (
b+65)=14 AND  PEEK (b+66)=14 THE
N  GO TO 300
 230 NEXT b: NEXT a
 240 GO TO 1000
 300 BEEP .5,-20: LET t=b-(32*l)
-64341: PRINT  AT l,t; BRIGHT 1;
"812"; BRIGHT 0
 310 PRINT  AT l+1,t; BRIGHT 1;"
7+3"; BRIGHT 0
 320 PRINT  AT l+2,t; BRIGHT 1;"
654"; BRIGHT 0
 330 POKE (b),15: POKE (b+1),15:
POKE (b+2),15: POKE (b+32),15:
POKE (b+33),15: POKE (b+34),15:
POKE (b+64),15: POKE (b+65),15:
POKE (b+66),15
 400 FOR b=1 TO 4
 410 RESTORE 500+(b*10): READ c,
d: RESTORE 600+(b*10): READ c$

 420 FOR a=1 TO 10
 430 LET n= INT ( RND *672)
 440 IF  PEEK (n+64341)=c THEN
LET l= INT (n/32): LET t= INT (n
-32*l): PRINT  AT l,t;c$: POKE (
n+64341),d: BEEP .005,16-t: GO T
O 460
 450 BEEP .005,20: GO TO 430
 460 NEXT a
 470 NEXT b
 510 DATA 0,16
 520 DATA 14,0
 530 DATA 13,13
 540 DATA 0,13
 610 DATA "K"
 620 DATA " "
 630 DATA "J"
 640 DATA "J"
1000 FOR n=65240 TO 65360 STEP 8
: LET m=n/8: IF  PEEK (m+57069)=
0 THEN  GO TO 2090
1100 RESTORE 7000: FOR x=1 TO  P
EEK (m+57053): READ g$: NEXT x

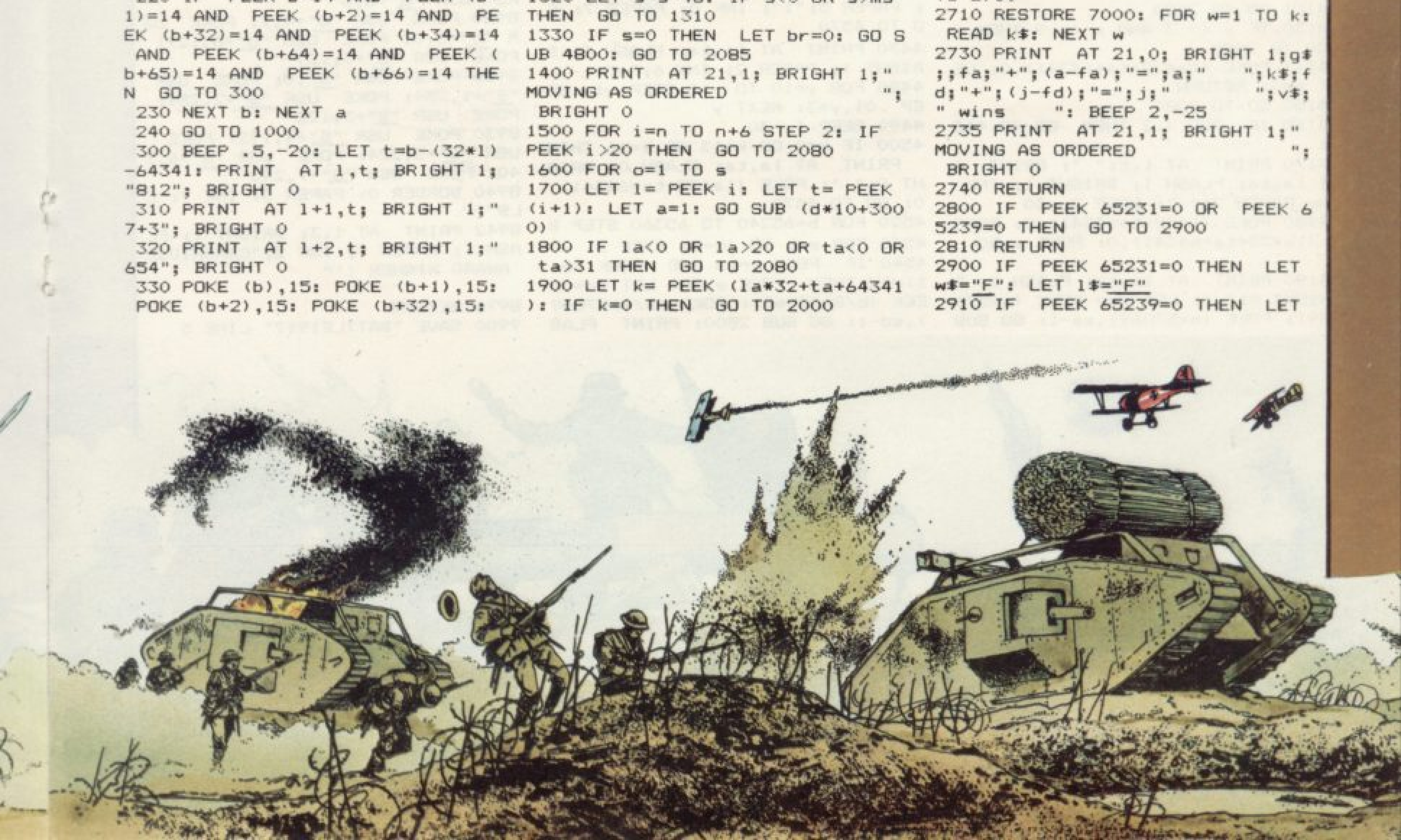
1110 LET x=x-1
1190 LET br=1: GO SUB 4800
1200 PRINT  AT 21,0; BRIGHT 1;g$
;" DIRECTION ?  (0 to 8)
 ": BRIGHT 0: POKE 23560,0
1210 LET d= PEEK 23560: IF d=0 T
HEN  GO TO 1210
1215 LET d=d-48: IF d<0 OR d>8 T
HEN  GO TO 1200
1220 IF d=0 THEN  LET br=0: GO S
UB 4800: GO TO 2085
1250 BEEP .05,15
1300 LET ms= PEEK (m+57037)
1310 PRINT  AT 21,1; BRIGHT 1;"
HOW FAR ?  (1 to ";ms;")
 "; BRIGHT 0: POKE 23560,0
1315 LET s= PEEK 23560: IF s=0 T
HEN  GO TO 1315
1320 LET s=s-48: IF s<0 OR s>ms
THEN  GO TO 1310
1330 IF s=0 THEN  LET br=0: GO S
UB 4800: GO TO 2085
1400 PRINT  AT 21,1; BRIGHT 1;"
MOVING AS ORDERED              ";
 BRIGHT 0
1500 FOR i=n TO n+6 STEP 2: IF
PEEK i>20 THEN  GO TO 2080
1600 FOR o=1 TO s
1700 LET l= PEEK i: LET t= PEEK
(i+1): LET a=1: GO SUB (d*10+300
0)
1800 IF la<0 OR la>20 OR ta<0 OR
 ta>31 THEN  GO TO 2080
1900 LET k= PEEK (la*32+ta+64341
): IF k=0 THEN  GO TO 2000
1910 GO SUB (k*10+4000)
2050 PRINT  AT l,t;" ": POKE (l*
32+t+64341),0
2060 PRINT  AT la,ta; BRIGHT 1;g
$; BRIGHT 0: POKE (la*32+ta+6434
1),x: POKE i,la: POKE (i+1),ta

2070 BEEP .001,20: NEXT o
2080 NEXT i
2085 LET br=0: GO SUB 4800: GO S
UB 4300
2090 BEEP .05,-20: NEXT n
2100 GO TO 1000
2500 PRINT  AT l,t; FLASH 1; BRI
GHT 1;g$; FLASH 0; BRIGHT 0: FOR
 b=65208 TO 65223: IF k= PEEK b
THEN  GO TO 2510
2505 NEXT b
2510 LET b=b-57053: LET fd= PEEK
 (b+56973): LET fa= PEEK (m+5697
3)
2520 LET a=fa+ INT ( RND *6): LE
T j=fd+ INT ( RND *6): IF a=j TH
EN  GO TO 2520
2525 IF a>j THEN  BEEP 1,-25: LE
T v$=g$: GO SUB 2710: GO TO 2600

2530 IF a<j THEN  BEEP 1,25: GO
SUB 2700: PRINT  AT l,t;" ": POK
E (l*32+t+64341),0
2540 LET sa= PEEK (m+57069): POK
E (m+57069),sa-1: GO SUB 2800
2550 FOR c=65240 TO 65366 STEP 2
: IF  PEEK c=l AND  PEEK (c+1)=t
 THEN  POKE c,50: GO TO 2080
2560 NEXT c
2600 LET k=0
2610 FOR b=65240 TO 65360 STEP 8

2620 FOR e=b TO (b+6) STEP 2
2630 IF  PEEK e=la AND  PEEK (e+
1)=ta THEN  POKE e,50: LET sd= P
EEK (b/8+57069): POKE (b/8+57069
),sd-1: GO SUB 2800: GO TO 2000

2640 NEXT e
2650 NEXT b
2700 RESTORE 7000: FOR w=1 TO k:
 READ k$: NEXT w: LET v$=k$: GO
TO 2730
2710 RESTORE 7000: FOR w=1 TO k:
 READ k$: NEXT w
2730 PRINT  AT 21,0; BRIGHT 1;g$
;;fa;"+";(a-fa);"=";a;"   ";k$;f
d;"+";(j-fd);"=";j;"   ";v$;
" wins    ": BEEP 2,-25
2735 PRINT  AT 21,1; BRIGHT 1;"
MOVING AS ORDERED              ";
 BRIGHT 0
2740 RETURN
2800 IF  PEEK 65231=0 OR  PEEK 6
5239=0 THEN  GO TO 2900
2810 RETURN
2900 IF  PEEK 65231=0 THEN  LET
w$="F": LET l$="F"
2910 IF  PEEK 65239=0 THEN  LET
```



```
1$="F": LET w$="F"
2912 PRINT AT 21,0; BRIGHT 1;l$
;" LOST"; FLASH 1;" ";w$;" WINS
!            "
2914 FOR b=0 TO 30: BEEP .1,b: B
EEP .15,10-b: BEEP .1,b-20: BORD
ER INT (b/4): NEXT b: BORDER 7

2919 PRINT AT 21,0; BRIGHT 1;l$
;" LOST"; FLASH 1;" ";w$;" WINS
!"; INK 1; PAPER 6;"  PRINTOUT ?
 y/n "; INK 0; PAPER 7; FLASH 0;
 BRIGHT 0
2920 POKE 23560,0
2922 LET z= PEEK 23560: IF z=0 T
HEN GO TO 2922
2924 IF z=121 THEN COPY
2929 PRINT AT 21,0; BRIGHT 1;l$
;" LOST"; FLASH 1;" ";w$;" WINS
!"; INK 1; PAPER 6;" PLAY AGAIN?
 y/n "; INK 0; PAPER 7; FLASH 0;
 BRIGHT 0
2930 POKE 23560,0
2940 LET z= PEEK 23560: IF z=0 T
HEN GO TO 2940
2950 IF z=121 THEN GO TO 7
2960 IF z=110 THEN NEW
2980 GO TO 2930
3010 LET la=l-a: LET ta=t: RETUR
N
3020 LET la=l-a: LET ta=t+a: RET
URN
3030 LET la=l: LET ta=t+a: RETUR
N
3040 LET la=l+a: LET ta=t+a: RET
URN
3050 LET la=l+a: LET ta=t: RETUR
N
3060 LET la=l+a: LET ta=t-a: RET
URN
3070 LET la=l: LET ta=t-a: RETUR
N
3080 LET la=l-a: LET ta=t-a: RET
URN
4000 RETURN
4060 IF x >= 7 THEN GO TO 2500

4061 GO TO 2080
4120 IF x <= 6 THEN GO TO 2500

4121 GO TO 2080
4130 IF x <> 3 AND x <> 9 THEN
GO TO 2080
4131 POKE (la*32+ta+64341),0: LE
T k=0: RETURN
4150 GO TO 2080
4160 IF RND >.2 THEN GO TO 413
1
4170 PRINT AT l,t;" ": PRINT A
T la,ta; FLASH 1; BRIGHT 1; INK
6; PAPER 2;" ": BEEP 2,-30
4180 POKE (l*32+t+64341),0: POKE
 (la*32+ta+64341),0: POKE 1,50

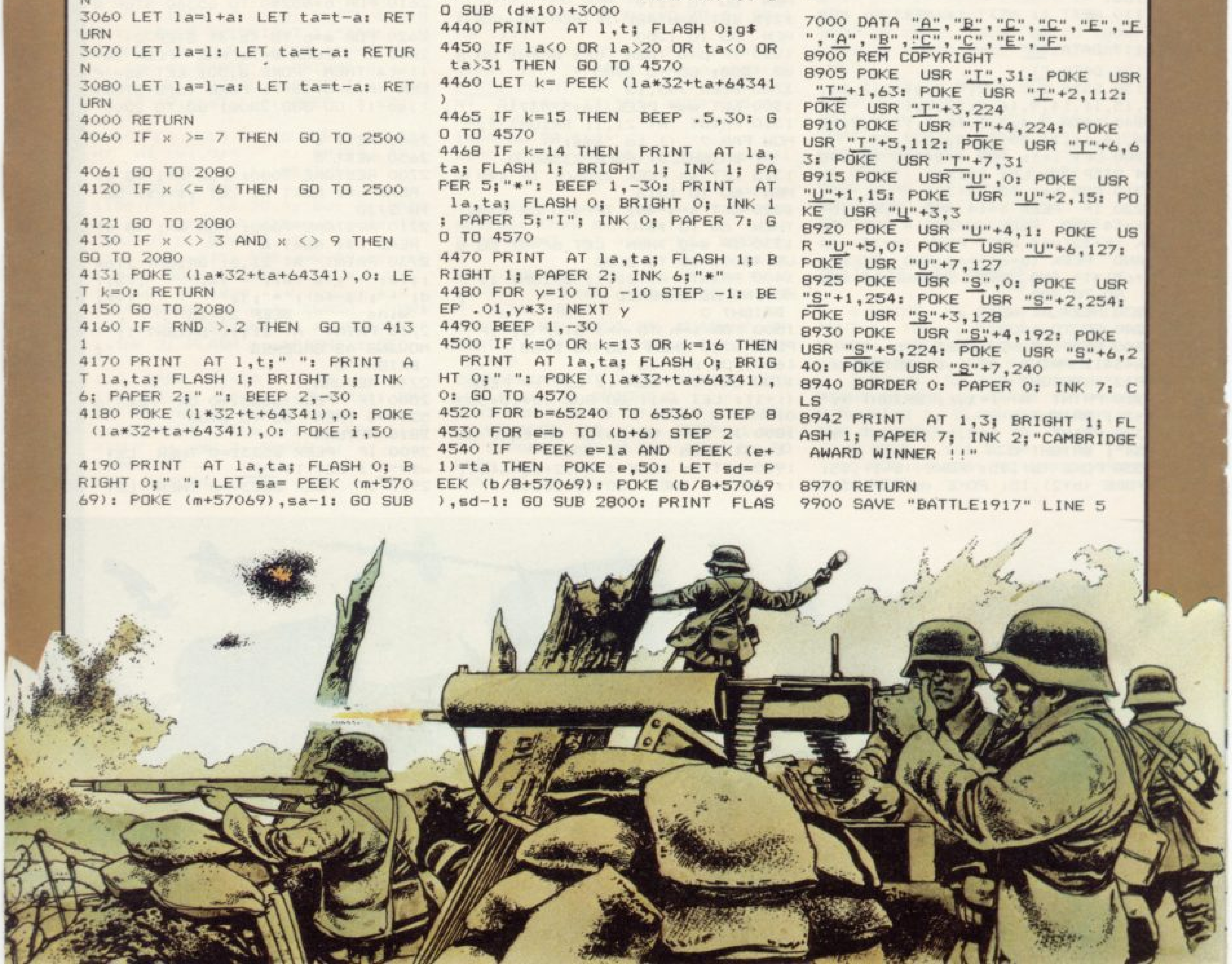
4190 PRINT AT la,ta; FLASH 0; B
RIGHT 0;" ": LET sa= PEEK (m+570
69): POKE (m+57069),sa-1: GO SUB
 2800: GO TO 2080
4300 IF x <> 5 AND x <> 11 THEN
 RETURN
4310 IF PEEK (m+57069)=0 THEN
RETURN
4320 LET br=1: GO SUB 4800
4330 PRINT AT 21,1; BRIGHT 1; I
NK 2;" DIRECTION TO FIRE ? (0 to
 8)  "; INK 0; BRIGHT 0: POKE 23
560,0
4340 LET d= PEEK 23560: IF d=0 T
HEN GO TO 4340
4345 LET d=d-48: IF d<0 OR d>8 T
HEN GO TO 4330
4350 IF d=0 THEN LET br=0: GO S
UB 4800: GO TO 2090
4360 PRINT AT 21,1; BRIGHT 1; I
NK 2;" RANGE ? (1 to 9)
   "; INK 0; BRIGHT 0: POKE 2356
0,0
4365 LET f= PEEK 23560: IF f=0 T
HEN GO TO 4365
4370 LET f=f-48: IF f<0 OR f>9 T
HEN GO TO 4360
4380 IF f=0 THEN LET br=0: GO S
UB 4800: GO TO 2090
4390 PRINT AT 21,1; BRIGHT 1; I
NK 2;" FIRING AS ORDERED
   "; INK 0; BRIGHT 0
4400 FOR z=n TO (n+6) STEP 2
4410 IF PEEK z>20 THEN GO TO 4
570
4420 LET l= PEEK z: LET t= PEEK
(z+1)
4430 PRINT AT l,t; FLASH 1;g$:
BEEP .5,-30
4435 LET a=f+ INT ( RND *3)-1: G
O SUB (d*10)+3000
4440 PRINT AT l,t; FLASH 0;g$
4450 IF la<0 OR la>20 OR ta<0 OR
 ta>31 THEN GO TO 4570
4460 LET k= PEEK (la*32+ta+64341
)
4465 IF k=15 THEN BEEP .5,30: G
O TO 4570
4468 IF k=14 THEN PRINT AT la,
ta; FLASH 1; BRIGHT 1; INK 1; PA
PER 5;"*": BEEP 1,-30: PRINT AT
 la,ta; FLASH 0; BRIGHT 0; INK 1
; PAPER 5;"I"; INK 0; PAPER 7: G
O TO 4570
4470 PRINT AT la,ta; FLASH 1; B
RIGHT 1; PAPER 2; INK 6;"*"
4480 FOR y=10 TO -10 STEP -1: BE
EP .01,y*3: NEXT y
4490 BEEP 1,-30
4500 IF k=0 OR k=13 OR k=16 THEN
 PRINT AT la,ta; FLASH 0; BRIG
HT 0;" ": POKE (la*32+ta+64341),
0: GO TO 4570
4520 FOR b=65240 TO 65360 STEP 8
4530 FOR e=b TO (b+6) STEP 2
4540 IF PEEK e=la AND PEEK (e+
1)=ta THEN POKE e,50: LET sd= P
EEK (b/8+57069): POKE (b/8+57069
),sd-1: GO SUB 2800: PRINT FLAS
H 0; BRIGHT 0; AT la,ta;" ": POK
E (la*32+ta+64341),0: GO TO 4570

4550 NEXT e
4560 NEXT b
4570 NEXT z
4580 RETURN
4800 FOR a=n TO (n+6) STEP 2

4810 IF PEEK a <= 20 THEN PRIN
T AT PEEK a, PEEK (a+1); BRIGH
T br;g$; BRIGHT 0
4820 NEXT a
4830 RETURN
5110 DATA 1,1,2,2,3,3,0,0,1,1,2,
2,3,3,0,0
5210 DATA 166,148,150,168,159,11
5,160,210
5510 DATA 5,5,6,6,3,3,3,2,5,5,6,
6,3,3,3,2
5610 DATA 1,1,2,2,3,3,5,6,7,7,8,
8,9,9,11,12
5710 DATA 4,4,4,4,4,4,4,1,4,4,4,
4,4,4,4,1
5810 DATA 1,6,1,7,0,6,0,7,1,24,1
,25,0,24,0,25,1,2,1,3,0,2,0,3,1,
28,1,29,0,28,0,29,1,10,1,11,0,10
,0,11,1,20,1,21,0,20,0,21,1,14,1
,15,1,16,1,17,50,50,50,50,50,50,
0,15
5910 DATA 19,6,19,7,20,6,20,7,19
,24,19,25,20,24,20,25,19,2,19,3,
20,2,20,3,19,28,19,29,20,28,20,2
9,19,10,19,11,20,10,20,11,19,20,
19,21,20,20,20,21,19,14,19,15,19
,16,19,17,50,50,50,50,50,50,20,1
6

7000 DATA "A","B","C","C","E","F
","A","B","C","C","E","F"
8900 REM COPYRIGHT
8905 POKE USR "T",31: POKE USR
 "T"+1,63: POKE USR "T"+2,112:
POKE USR "T"+3,224
8910 POKE USR "T"+4,224: POKE
USR "T"+5,112: POKE USR "T"+6,6
3: POKE USR "T"+7,31
8915 POKE USR "U",0: POKE USR
"U"+1,15: POKE USR "U"+2,15: PO
KE USR "U"+3,3
8920 POKE USR "U"+4,1: POKE US
R "U"+5,0: POKE USR "U"+6,127:
POKE USR "U"+7,127
8925 POKE USR "S",0: POKE USR
"S"+1,254: POKE USR "S"+2,254:
POKE USR "S"+3,128
8930 POKE USR "S"+4,192: POKE
USR "S"+5,224: POKE USR "S"+6,2
40: POKE USR "S"+7,240
8940 BORDER 0: PAPER 0: INK 7: C
LS
8942 PRINT AT 1,3; BRIGHT 1; FL
ASH 1; PAPER 7; INK 2;"CAMBRIDGE
 AWARD WINNER !!"

8970 RETURN
9900 SAVE "BATTLE1917" LINE 5
```



SEMAPHORE

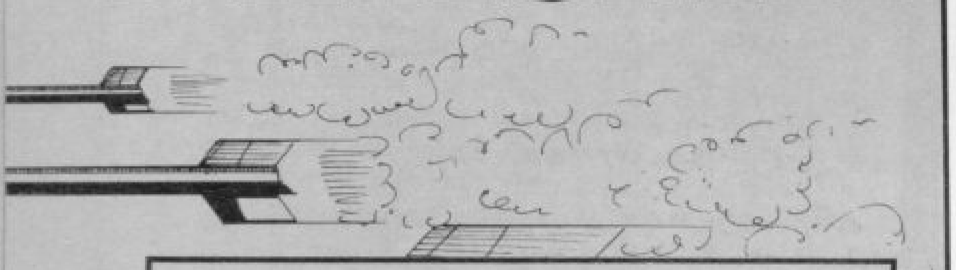


SEMAPHORE was written for the 16K ZX-81 by David Tulett, aged 14, of Edinburgh and is best played with a friend. The players take turns to write a message which the other person must decipher. There are six speeds from which to choose and a lower number will give you slower signals.

The man in the middle of the screen will display the message which has been input using **Semaphore** signals. A repeat facility is incorporated if it is necessary for the message to be viewed again. The game can be played by those unfamiliar with semaphore signals, as typing-in the alphabet will give you a demonstration run.

```
   2 PRINT ,,"      THIS PROGRAM
 FOR SENDING  MESSAGES BY SEMAPH
ORE SIGNALLING"
   4 FOR N=1 TO 200
   6 NEXT N
   9 CLS
  10 PRINT AT 0,0;"SPEED  (1 TO 6
)? "
  20 INPUT A
  25 IF A=1 THEN LET PAUSE=300
  30 IF A=2 THEN LET PAUSE=200
  40 IF A=3 THEN LET PAUSE=100
  45 IF A=4 THEN LET PAUSE=50
  46 IF A=5 THEN LET PAUSE=25
  47 IF A=6 THEN LET PAUSE=0
  50 PRINT AT 0,0;"MESSAGE?
"
  60 INPUT B$
  70 PRINT AT 0,0;"TO START, HIT
ANY KEY"
  80 IF INKEY$<>"" THEN GOTO 80
  90 IF INKEY$="" THEN GOTO 85
  95 PRINT AT 0,0;"
     "
 100 FOR N=1 TO LEN B$
 110 PRINT AT 12,12;"O"
 120 PRINT AT 13,12;"█"
 130 PRINT AT 14,12;"█"
 140 PRINT AT 15,12;"█"
 145 PRINT AT 16,11;" ▄█▄ "
 150 IF B$(N)="A" THEN PRINT AT
13,11;"▞";AT 14,10;"▞"
 160 IF B$(N)="B" THEN PRINT AT
13,10;"▬";AT 13,11;"▬"
 170 IF B$(N)="C" THEN PRINT AT
11,10;"▚";AT 12,11;"▚"
 180 IF B$(N)="D" THEN PRINT AT
11,11;" ▌";AT 12,11;" ▌";AT 13,11;
" ▪"
 190 IF B$(N)="E" THEN PRINT AT
11,14;"▞";AT 12,13;"▞"
 200 IF B$(N)="F" THEN PRINT AT
13,13;"▬";AT 13,14;"▬"
 210 IF B$(N)="G" THEN PRINT AT
13,13;"▚";AT 14,14;"▚"
 220 IF B$(N)="H" THEN PRINT AT
13,10;"▬";AT 13,11;"▬";AT 14,11;
"▞";AT 15,10;" ▪"
 230 IF B$(N)="I" THEN PRINT AT
11,10;"▚";AT 12,11;"▚";AT 14,11;
"▞";AT 15,10;"▞"
 240 IF B$(N)="J" THEN PRINT AT
11,11;" ▌";AT 12,11;" ▌";AT 13,11;
" ▪";AT 13,13;"▬";AT 13,14;"▬"
 250 IF B$(N)="K" THEN PRINT AT
11,13;"▌ ";AT 12,13;"▌ ";AT 13,13;
"▪ ";AT 13,11;"▞";AT 14,10;"▞"
 260 IF B$(N)="L" THEN PRINT AT
11,14;"▞";AT 12,13;"▞";AT 13,11;
"▞";AT 14,10;"▞"
 270 IF B$(N)="M" THEN PRINT AT
13,11;"▞";AT 14,10;"▞";AT 13,13;
"▬";AT 13,14;"▬"
 280 IF B$(N)="N" THEN PRINT AT
13,11;"▞";AT 14,10;"▞";AT 13,13;
"▚";AT 14,14;"▚"
 290 IF B$(N)="O" THEN PRINT AT
13,10;" ▪";AT 13,11;"▬";AT 11,10;
"▚";AT 12,11;"▚"
 300 IF B$(N)="P" THEN PRINT AT
11,13;"▌ ";AT 12,13;"▌ ";AT 13,13;
"▪ ";AT 13,10;"▬";AT 13,11;"▬"
 310 IF B$(N)="Q" THEN PRINT AT
13,10;"▬";AT 13,11;"▬";AT 12,13;
"▞";AT 11,14;"▞"
 320 IF B$(N)="R" THEN PRINT AT
13,10;"▬";AT 13,11;"▬";AT 13,13;
"▬";AT 13,14;"▬"
 330 IF B$(N)="S" THEN PRINT AT
13,10;"▬";AT 13,11;"▬";AT 13,13;
"▚";AT 14,14;"▚"
 340 IF B$(N)="T" THEN PRINT AT
11,10;"▚";AT 12,11;"▚";AT 11,13;
"▌ ";AT 12,13;"▌ ";AT 13,13;"▪ "
 350 IF B$(N)="U" THEN PRINT AT
11,10;"▚";AT 12,11;"▚";AT 12,13;
"▞";AT 11,14;"▞"
 360 IF B$(N)="V" THEN PRINT AT
11,11;" ▌";AT 12,11;" ▌";AT 13,11;
" ▪";AT 13,13;"▚";AT 14,14;"▚"
 370 IF B$(N)="W" THEN PRINT AT
11,14;"▞";AT 12,13;"▞";AT 13,13;
"▬";AT 13,14;"▬"
 380 IF B$(N)="X" THEN PRINT AT
11,14;"▞";AT 12,13;"▞";AT 14,13;
"▚";AT 15,14;"▪ "
 390 IF B$(N)="Y" THEN PRINT AT
11,10;"▚";AT 12,11;"▚";AT 13,13;
"▬";AT 13,14;"▬"
 400 IF B$(N)="Z" THEN PRINT AT
13,13;"▬";AT 13,14;"▬";AT 14,13;
"▚";AT 15,14;"▪ "
 410 FOR M=1 TO PAUSE
 420 NEXT M
 425 CLS
 430 NEXT N
 440 CLS
 450 PRINT AT 0,0;"REPEAT  (Y OR
N)?"
 460 INPUT C$
 470 IF C$="Y" THEN GOTO 490
 480 GOTO 10
 490 CLS
 500 GOTO 100
```

SHAZMA PLASMA



SHOOT THE APPROACHING enemy with your **Shazma Plazma** bolts. The bolts are designed to catch the aliens by surprise. Once the aliens are within firing range the computer will flash a message on the screen and you must then fire at them using the "P". The bolts pass through the aliens and then rebound off the wall, destroying them from behind. There are several levels to be played and the aliens move at a faster speed as the game progresses. Written for the 16K Spectrum by Chris Duncan, aged 14, of Staines, Middlesex.

```
   2 RESTORE 9000
   5 BORDER 0: PAPER 0: INK 6: C
LS
  10 FOR q=0 TO 15: READ w: POKE
 USR "a"+q,w: NEXT q
  15 LET ammo=9: LET lev=1: LET
sc=0
  17 LET h=0: LET x=10: LET y=0

  19 CLS : LET ammo=9+lev: LET h
=h+.25
  20 FOR r=0 TO 4: LET a= INT (
RND *19): LET b=31: LET y$="b":
LET a$="a"
  25 PRINT  AT 21,0;"SCORE:"; IN
T sc; AT 21,11;"AMMO:";ammo; AT
21,29;"L";lev; AT a,b; INK  INT
( RND *7)+3;a$: NEXT r
  26 PRINT  AT x,y; INK 6;y$: BE
EP .005,a: PRINT  AT x,y;" "
  27 PLOT 165,8: DRAW 0,167
  30 IF  INKEY$ ="q" THEN  LET x
=x-1: IF x <= 0 THEN  LET x=0
  31 IF  INKEY$ ="z" THEN  LET x
=x+1: IF x >= 20 THEN  LET x=20

  35 IF  INKEY$ ="p" THEN  GO TO
 200
  38 BORDER  INT ( RND *7)+1
  40 PRINT  AT a,b;" ": LET b=b-
h
  42 IF x=a AND  INT b <= 0 THEN
 GO TO 400
  45 IF b <= 0 THEN  PRINT  AT a
,0;" ": IF b <= 0 THEN  GO TO 70

  50 IF b <= 20 THEN  GO TO 100

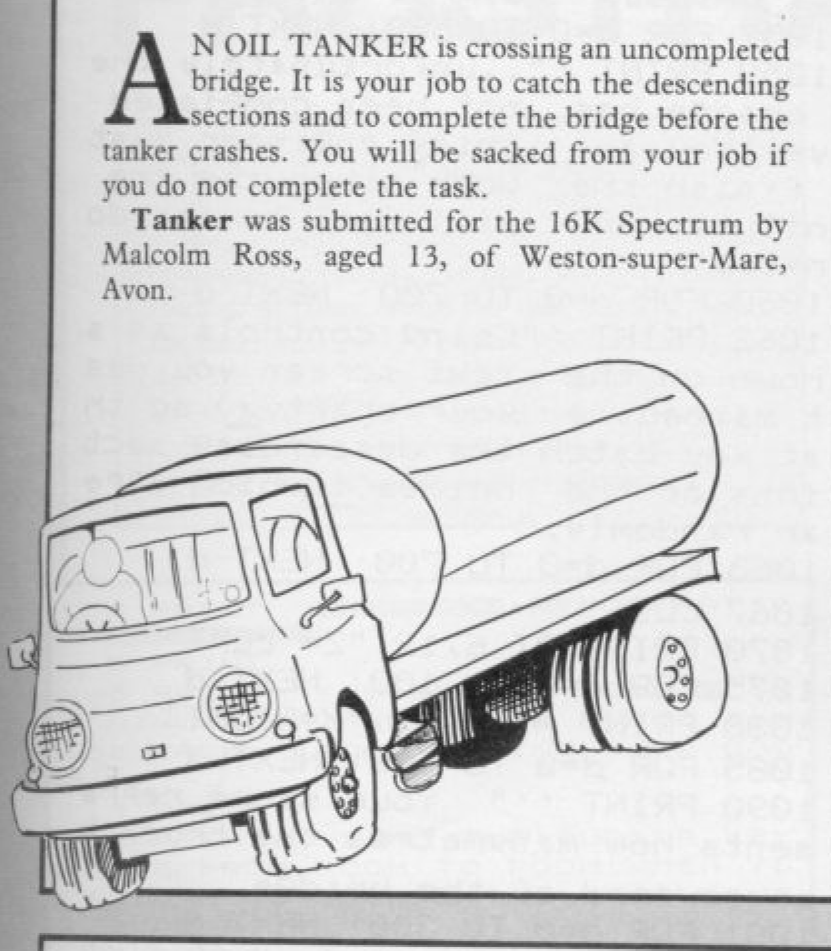
  60 GO TO 25
  70 LET sc=sc-50: GO TO 20
 100 PRINT  AT 21,19; FLASH 1; I
NK 6;"[IN RANGE]"
 110 GO TO 25
 200 LET ammo=ammo-1: FOR q=y+1
TO 20 STEP 2: BEEP .001, RND *20
: PRINT  AT x,y;y$: PRINT  AT x,
q;"-": PRINT  AT x,q;" ": NEXT q
: FOR q=20 TO y+1 STEP -1: PRINT
 AT x,q;"=": PRINT  AT x,q;" ":
 NEXT q: NEXT q: IF ammo=0 THEN
 GO TO 8500
 201 IF x=a AND b <= 20 THEN  LE
T p=b-y: LET sc=sc+p*5: IF sc >=
 500*lev THEN  GO TO 800: PRINT
 AT a,b;" "
 202 BORDER 0: CLS
 250 GO TO 20
 268 PRINT  AT x,y; INK 6;y$: BE
EP .005,a: PRINT  AT x,y;" "
 400 PRINT  AT x,y; INK 7;y$; AT
 x,y; OVER 1;a$: PRINT "YOU ARE
DEAD": GO SUB 9900: GO SUB 9990:
 PRINT  AT x+2,y; FLASH 1;"PRESS
 ENTER"
 401 IF  INKEY$ ="" THEN  GO TO
401
 402 GO TO 1
 800 LET lev=lev+1: CLS : PRINT
 AT 7,5;"LEVEL:";lev
 801 PRINT  AT 9,5;"PRESS ENTER
AND BE PREPARED": GO SUB 9990
 802 IF  INKEY$ ="" THEN  GO TO
802
 803 CLS : GO TO 19
8500 CLS : PRINT "YOU RAN OUT OF
 AMMO"; AT 2,0;"YOUR SCORE IS ";
 INT sc; AT 3,0;"PRESS ANY KEY"

8510 IF  INKEY$ ="" THEN  GO TO
8510
8512 GO TO 1
9000 DATA 51,90,90,90,126,90,90,
37
9010 DATA 0,0,248,140,143,140,24
8,0
9900 FOR r=0 TO 100: OUT 44+32,2
.3: OUT 180,255: NEXT r
9910 RETURN
9990 BORDER 1: BEEP .5,7: BORDER
 0: BEEP .5,9: BORDER 2: BEEP .5
,5: BORDER 4: BEEP .5,-2: BORDER
 6: BEEP .5,0
9999 RETURN
```

TANKER

A N OIL TANKER is crossing an uncompleted bridge. It is your job to catch the descending sections and to complete the bridge before the tanker crashes. You will be sacked from your job if you do not complete the task.

Tanker was submitted for the 16K Spectrum by Malcolm Ross, aged 13, of Weston-super-Mare, Avon.



```
 1 CLS
 2 GO SUB 1000
 4 BORDER 1: PAPER 1: CLS
 8 FOR l=0 TO 5
 10 FOR m=0 TO 15
 12 PLOT 0,0: DRAW  INK 4;l+m,m
 14 PLOT 245,0: DRAW  INK 4;l-m
,m
 16 NEXT m
 18 NEXT l
 20 LET x=16: LET y=15
 22 LET a$="j"
 25 FOR t=0 TO 22
 27 LET sc=t*10
 30 LET r=INT (RND*25)+1
 40 FOR s=0 TO 15
 50 LET b$="i"
 70 IF INKEY$="z" THEN  LET y=y
-1
 80 PRINT AT x,y+1;" "
 90 IF INKEY$="x" THEN  LET y=y
+1
 100 PRINT AT x,y-1;" "
 110 PRINT  INK 5; BRIGHT 1;AT x
,y;a$
 130 PRINT  INK 4; BRIGHT 1;AT s
,r;b$
 140 PRINT AT s-1,r;" "
 145 BEEP .01,10-s
 150 PRINT AT x,0;" "
 160 PRINT AT x,31;" "
 170 IF y=0 THEN  LET y=30
 180 IF y=31 THEN  LET y=0
 185 LET a=18: LET b=4
 187 IF t=22 THEN  GO TO 835
 190 NEXT s
 200 IF x-1<>s AND y<>r THEN  GO
 TO 710
 210 PRINT AT x-1,y;" "
 220 BEEP .02,20
 230 PRINT  INK 4; BRIGHT 1;AT a
+2,b+t+3;b$
 500 LET c$="ace9"
 510 LET d$="bdfh"
 530 PRINT  INK 4; BRIGHT 1;AT a
+2,b-2;"iiiii"
 540 PRINT  INK 3; BRIGHT 1;AT a
,b+t;c$;AT a+1,b+t;d$
 550 PRINT AT a,b-t-7;" ";AT a+1
,b-t-7;" "
 560 BEEP .2,-20
 570 PRINT  INK 7; BRIGHT 1;AT 2
1,11;"SCORE=000"
 580 PRINT  INK 7; BRIGHT 1;AT 2
1,18;sc
 590 NEXT t
 710 PRINT  INK 6;AT a,b+t-1;"km
o9"
 715 PRINT  INK 6;AT a+1,b+t-1;"
lnPr"
 720 FOR f=0 TO -30 STEP -1
 730 BEEP .02,f
 740 NEXT f
 745 FOR d=0 TO 100: NEXT d
 750 BORDER 2: PAPER 2: INK 0: C
LS
 760 PRINT TAB 12;"RESULTS"
 770 PRINT AT 1,12;"iiiiiii"
 775 FOR d=0 TO 100: NEXT d
 780 PRINT '"  Your incompetance
 has caused  the oil tanker to c
rash..."
 785 FOR d=0 TO 400: NEXT d
 790 PRINT '"..the tanker inevit
ably explodedthe driver was kill
ed and the   oil was lost..."
 795 FOR d=0 TO 500: NEXT d
 800 PRINT '"..it was a costly m
istake..."
 805 FOR d=0 TO 300: NEXT d
 810 PRINT '"..the company canno
t afford to  lose money..."
 815 FOR d=0 TO 400: NEXT d
 820 PRINT '"..the Boss has deci
ded to give  you the sack!"
 830 STOP
 840 FOR n=0 TO 3
 850 FOR e=40 TO 20 STEP -1
 860 BEEP .002,e
 870 NEXT e
 880 NEXT n
```

continued on page 80

continued from page 79

```
 890 BORDER 2: PAPER 2: INK 0: C
LS
 900 PRINT TAB 12;"RESULTS"
 910 PRINT AT 1,12;"iiiiiii"
 915 FOR d=0 TO 100: NEXT d
 920 PRINT '"  Congratulations!
Your amazing skill enabled the o
il tanker to cross the bridge wh
ere so many  others have failed.
.."
 925 FOR d=0 TO 600: NEXT d
 930 PRINT '"..the Boss has deci
ded to extendthe contract betwee
n you and him"
 935 FOR d=0 TO 350: NEXT d
 940 PRINT '"  What do you say..
."
 945 FOR d=0 TO 200: NEXT d
 950 PRINT '"..do you agree to t
his..."
 960 PRINT AT 16,7;"YES or NO"
 970 INPUT  LINE y$
 980 IF y$="yes" OR y$="y" THEN
 GO TO 4
 990 STOP
1000 FOR n=1 TO 18: READ a$: FOR
 l=0 TO 7: READ b: POKE USR a$+l
,b: NEXT l: NEXT n
1010 DATA "a",0,0,0,63,63,113,11
7,117,"b",113,63,31,6,9,9,6,0,"c
",0,0,0,255,255,239,255,239,"d",
239,255,255,24,36,36,24,0,"e",0,
0,0,248,248,124,124,124,"f",24,2
48,255,0,0,0,0,0,"g",0,0,0,248,1
32,130,194,254,"h",254,254,254,4
8,72,72,48,0
1020 DATA "i",255,85,255,0,0,0,0
,0
1030 DATA "j",255,24,60,60,153,2
55,129,129
1032 DATA "k",128,96,56,28,15,7,
3,1,"l",0,1,3,7,14,24,32,0,"m",0
,1,2,14,28,255,136,170,"n",152,1
70,130,255,7,14,24,32,"o",0,16,3
2,99,207,255,136,171,"p",170,170
,168,255,140,8,16,0,"q",1,14,124
,248,240,224,192,128,"r",128,192
,240,248,198,97,32,16
1038 BORDER 6: PAPER 6: INK 1: C
LS
1040 PRINT AT 11,0;"Do you requi
re instructions(y/n)"
1042 INPUT  LINE q$
1044 IF q$="n" THEN  CLS : GO TO
 1100
1046 CLS
1048 PRINT TAB 10;"INSTRUCTIONS"
1050 PRINT AT 1,10;"iiiiiiiiiiii
"
```

```
1055 PRINT '"  You are responsib
le for the   safety of an oil ta
nker.The oil tanker has to cross
 a bridge.   Simple eh?"
1057 FOR d=0 TO 500: NEXT d
1059 PRINT '"..unfortunately the
 bridge has  not been completed
yet!You,as   chief engineer must
 finish the  work otherwise the
oil tanker   will fall to its do
om..."
1060 FOR d=0 TO 700: NEXT d
1062 PRINT '"Using controls as s
hown on the  next screen you mus
t manoeuvre  your craft(j) so th
at you catch the descending sect
ions of the  bridge(i)which appe
ar randomly."
1065 FOR d=0 TO 700: NEXT d
1067 CLS
1070 PRINT AT 6,12;"Z= LEFT"
1075 FOR d=0 TO 100: NEXT d
1080 PRINT AT 8,12;"X=RIGHT"
1085 FOR d=0 TO 100: NEXT d
1090 PRINT ''"  Your score repre
sents how manymetres the truck h
as covered of the bridge..."
1091 FOR d=0 TO 300: NEXT d
1092 PRINT AT 17,10;"..GOOD LUCK
"
1095 FOR d=0 TO 50: NEXT d
1100 BEEP .2,10: FOR d=0 TO 12:
NEXT d: BEEP .2,10: FOR d=0 TO 1
2: NEXT d: BEEP .1,10: FOR d=0 T
O 7: NEXT d: BEEP .2,9
1110 FOR d=0 TO 20: NEXT d: BEEP
 .2,12: FOR d=0 TO 12: NEXT d: B
EEP .2,12: FOR d=0 TO 12: NEXT d
: BEEP .1,12: FOR d=0 TO 7: NEXT
 d: BEEP .2,11
1130 FOR d=0 TO 20: NEXT d: BEEP
 .2,10: FOR d=0 TO 12: NEXT d: B
EEP .2,10: FOR d=0 TO 12: NEXT d
: BEEP .1,10: FOR d=0 TO 7: NEXT
 d: BEEP .2,9
1140 FOR d=0 TO 5: NEXT d: BEEP
.1,12: FOR d=0 TO 3: NEXT d: BEE
P .1,11: FOR d=0 TO 6: NEXT d: B
EEP .2,13: FOR d=0 TO 6: NEXT d:
 BEEP .1,13: FOR d=0 TO 6: NEXT
d: BEEP .3,12
1150 FOR c=6 TO 1 STEP -1
1160 BORDER c: PAPER c: CLS
1165 BEEP .02,c+20
1170 FOR d=0 TO 10: NEXT d
1180 NEXT c
1190 FOR d=0 TO 100
1700 RETURN
```

FRUSTRATION

THE object of the game is to visit each of the nine rooms once only with the exception of room A, which you need to visit twice to pass through the exit. Each of the nine rooms has four exits. To gain the maximum of 100 points you must only go through each room once, so making a map would be useful in achieving this.

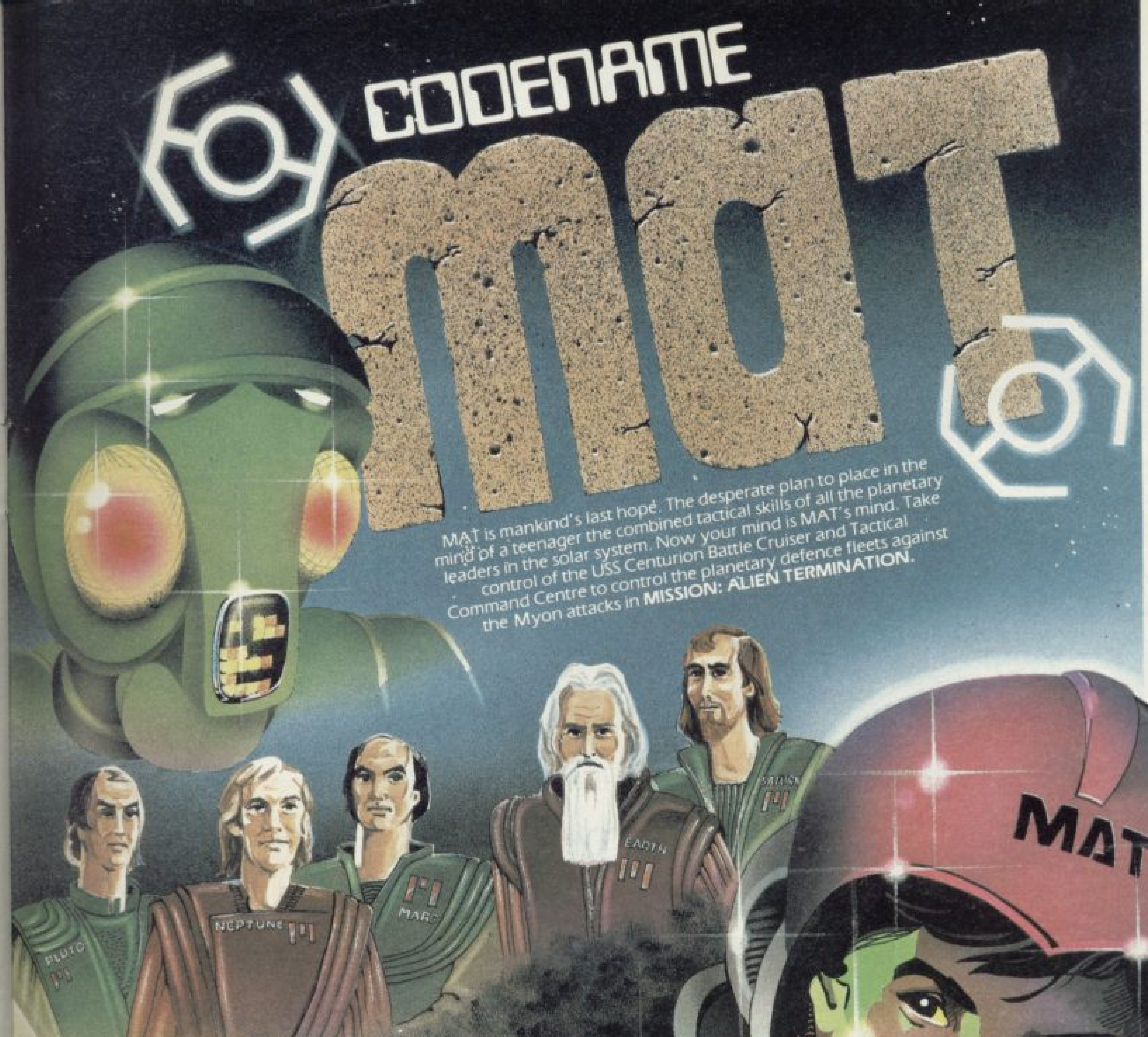
Frustration was written for the 16K ZX-81 by John Harlow of Bridgwater, Somerset.

```
   3 PRINT "▒▒▒▒▒▒▒▒▒▒▒*▒FRUSTRATIO
N▒*▒▒▒▒▒▒▒▒▒▒▒"
   5 PRINT
   6 PRINT "YOU ARE IN ROOM A OF
 A NINE ROOM(A,B,C,D,E,F,G,H,I)H
OUSE,EACH    ROOM HAVING FOUR DOO
RS."
   7 PRINT
   8 PRINT "USING THE CURSOR KEY
S MOVE FROM ROOM TO ROOM.WHEN YO
U RETURN TO ROOM A THE EXIT ▒ WI
LL APPEAR"
   9 PRINT
  10 PRINT "YOU CAN ONLY ACHIEVE
 MAXIMUM       SCORE(100) IF YOU VIS
IT EACH ROOMONLY ONCE APART FROM
 A FINAL      VISIT TO ROOM A"
  11 PRINT
  12 PRINT "THIS IS NOT AS IMPOS
SIBLE AS IT MAY SEEM."
  13 PRINT
  14 PRINT "NEWLINE TO START.GOO
D LUCK"
  15 PAUSE 4E4
  16 CLS
  20 LET A=0
  21 LET B=0
  22 LET C=0
  23 LET D=0
  24 LET E=0
  25 LET F=0
  26 LET G=0
  27 LET H=0
  28 LET I=0
  29 LET S=100
  30 GOTO 700
  40 IF A=1 THEN PRINT AT 0,22;"
ROOM A";AT 15,22;"ROOMS";AT 16,2
2;"VISITED";AT 17,22;"SO FAR"
  41 IF B=1 THEN PRINT AT 4,22;"
ROOM E"
  42 IF C=1 THEN PRINT AT 7,22;"
ROOM H"
  43 IF D=1 THEN PRINT AT 1,22;"
ROOM B"
  44 IF E=1 THEN PRINT AT 6,22;"
ROOM G"
  45 IF F=1 THEN PRINT AT 3,22;"
ROOM D"
  46 IF G=1 THEN PRINT AT 5,22;"
ROOM F"
  47 IF H=1 THEN PRINT AT 2,22;"
ROOM C"
  48 IF I=1 THEN PRINT AT 8,22;"
```



```
ROOM I"
  49 LET X=11
  50 LET Y=11
  51 PRINT AT Y,X;"▒"
  55 LET X=X+(INKEY$="8")-(INKEY
$="5")
  60 LET Y=Y+(INKEY$="6")-(INKEY
$="7")
  65 PRINT AT Y,X;
  70 LET P=PEEK (PEEK 16398+256*
PEEK 16399)
  71 IF P=29 OR P=39 OR P=63 OR
P=55 THEN GOTO 250
  72 IF P=23 OR P=30 OR P=53 OR
P=28 THEN GOTO 300
  73 IF P=54 OR P=52 OR P=42 OR
P=33 THEN GOTO 350
  74 IF P=51 OR P=40 OR P=56 OR
P=34 THEN GOTO 400
  75 IF P=41 OR P=61 OR P=50 OR
P=32 THEN GOTO 450
  76 IF P=37 OR P=49 OR P=44 OR
P=59 THEN GOTO 500
  77 IF P=48 OR P=38 OR P=35 OR
P=58 THEN GOTO 550
  78 IF P=43 OR P=47 OR P=57 OR
P=36 THEN GOTO 600
  79 IF P=31 OR P=62 OR P=60 OR
P=45 THEN GOTO 200
  80 IF P=8 THEN GOTO 2000
  81 IF P=128 THEN GOTO 49
  85 PRINT AT Y,X;"■"
  90 GOTO 51
 100 CLS
 110 FAST
 120 PRINT AT 0,0;"████████████████████
████████"
 121 FOR N=1 TO 20
 130 PRINT AT N,0;"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒
▒▒▒▒▒▒▒▒"
 140 NEXT N
 145 PRINT AT 21,0;"████████████████████
████████"
 150 SLOW
 160 RETURN
 200 GOSUB 100
 210 GOSUB 1000
 220 LET A=1
 230 LET S=S-1
 240 GOTO 40
 250 GOSUB 100
 260 GOSUB 1050
 270 LET B=1
 280 LET S=S-1
 290 GOTO 40
 300 GOSUB 100
 310 GOSUB 1100
 320 LET C=1
 330 LET S=S-1
 340 GOTO 40
 350 GOSUB 100
 360 GOSUB 1150
 370 LET D=1
 380 LET S=S-1
 390 GOTO 40
 400 GOSUB 100
 410 GOSUB 1200
 420 LET E=1
 430 LET S=S-1
 440 GOTO 40
 450 GOSUB 100
 460 GOSUB 1250
 470 LET F=1
 480 LET S=S-1
 490 GOTO 40
 500 GOSUB 100
 510 GOSUB 1300
 520 LET G=1
 530 LET S=S-1
 540 GOTO 40
 550 GOSUB 100
 560 GOSUB 1350
 570 LET H=1
 580 LET S=S-1
 590 GOTO 40
 600 GOSUB 100
 610 GOSUB 1400
 620 LET I=1
 630 LET S=S-1
 640 GOTO 40
 700 GOSUB 100
 710 GOSUB 1500
 720 LET A=1
 730 LET S=S-1
 740 GOTO 40
1000 PRINT AT 0,11;"1";AT 11,0;"
V";AT 11,21;"X";AT 21,11;"▒";AT
2,2;"■";AT 20,12;"EXIT"
1010 RETURN
1050 PRINT AT 0,11;"2";AT 11,0;"
U";AT 11,21;"S";AT 21,11;"H";AT
2,2;"■";
1060 RETURN
1100 PRINT AT 0,11;"3";AT 11,0;"
T";AT 11,21;"Q";AT 21,11;"B";AT
2,2;"■"
1110 RETURN
1150 PRINT AT 0,11;"4";AT 11,0;"
O";AT 11,21;"J";AT 21,11;"C";AT
2,2;"■"
1160 RETURN
1200 PRINT AT 0,11;"5";AT 11,0;"
Z";AT 11,21;"K";AT 21,11;"D";AT
2,2;"■"
1210 RETURN
1250 PRINT AT 0,11;"6";AT 11,0;"
Y";AT 11,21;"L";AT 21,11;"E";AT
2,2;"■"
1260 RETURN
1300 PRINT AT 0,11;"7";AT 11,0;"
M";AT 11,21;"W";AT 21,11;"F";AT
2,2;"■"
1310 RETURN
1350 PRINT AT 0,11;"8";AT 11,0;"
N";AT 11,21;"R";AT 21,11;"G";AT
2,2;"■"
1360 RETURN
1400 PRINT AT 0,11;"9";AT 11,0;"
O";AT 11,21;"P";AT 21,11;"A";AT
2,2;"■"
1410 RETURN
1500 PRINT AT 0,11;"1";AT 11,0;"
V";AT 11,21;"X";AT 21,11;"*";AT
2,2;"■"
1510 RETURN
2000 IF A=1 AND B=1 AND C=1 AND
D=1 AND E=1 AND F=1 AND G=1 AND
H=1 AND I=1 THEN GOTO 2100
2010 CLS
2020 PRINT "YOU DID NOT VISIT EV
ERY ROOM.    SCORE:";100-S
2030 PRINT
2040 PRINT "PLAY FRUSTRATION AGA
IN?        PRESS NEWLINE"
2050 PAUSE 4E4
2060 CLS
2070 GOTO 20
2100 CLS
2200 PRINT "WELL DONE.YOU VISITE
D EVERY ROOMYOUR SCORE IS:";S+10

2300 PRINT "PLAY AGAIN?PRESS NEW
LINE"
2400 PAUSE 4E4
2500 CLS
2600 GOTO 20
```



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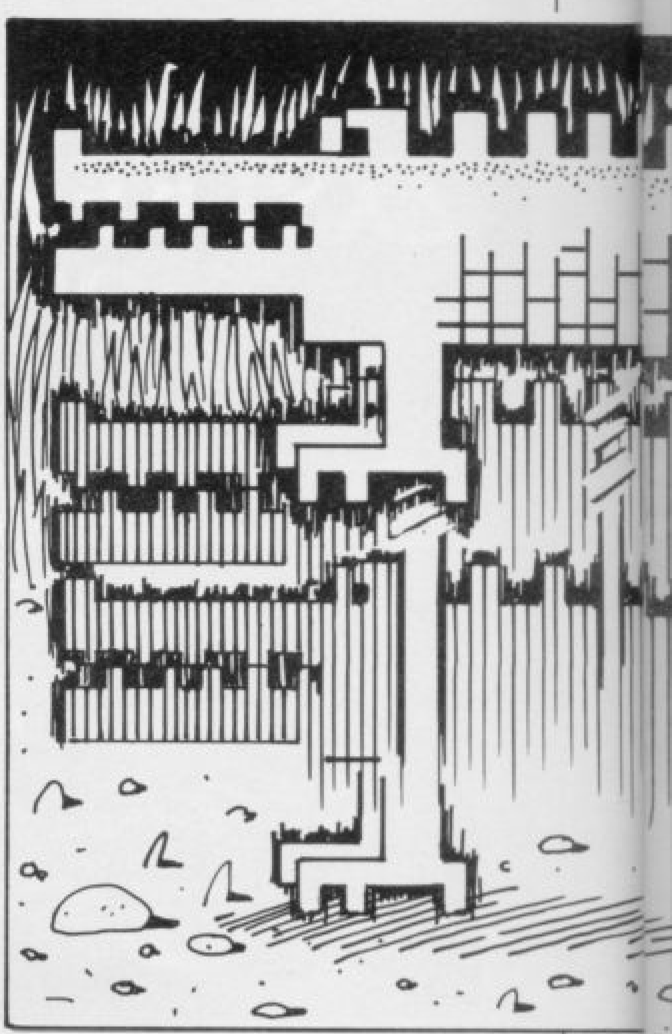
John Kerrigan gives his machine code alligator a new direction

Shifting up and down one scan at a time

ROUTINES to make a figure of any size slide horizontally one pixel to the left or one pixel to the right were dealt with last month. A pixel is the smallest horizontal distance possible on the Spectrum screen, one-eighth of a normal character. The routines were contained in a Basic program which consisted of two parts. Lines 10 to 260 were detailed in box two of the article in the March issue. Lines 270 to 610 were shown in box three of the April issue.

If you typed in the full program, you should have found that the figure moved left when you hit the "l" key and right when you hit the "r" key. If you hold down either key the figure should continue in the same direction.

A friend of mine was disappointed at how slowly it moved. The reason is not that the machine code routines are slow but that they are being called for Basic via the INKEY$ function. If the routines repeated themselves without the pause demanded by INKEY$ — and the default value of the system variable REPPER at 23562 — they would act so quickly that the alligator would scuttle off the screen almost before you could see it.



Box 1.

```
7290              00100        ORG 7290H
7290  2AF771      00110 S6     LD HL, (V1)     ;LOCATION IN SCREEN MEMORY
7293  CD0070      00120        CALL S0         ;DOWN A SCAN
7296  ED5BF771    00130        LD DE, (V1)     ;NOW DE POINTS TO SCAN ABOVE
                                               HL
729A  22F771      00140        LD (V1), HL     ;NOW V1 IS 1 SCAN DOWN
729D  ED4BF971    00150        LD BC, (V2)     ;C=NO. OF BYTES PER SCAN
72A1  0600        00160        LD B, 0         ;REMOVE RUBBISH FROM B
72A3  EDB8        00170        LDDR
72A5  3AFA71      00180        LD A, (V3)      ;NO. OF SCANS LEFT TO MOVE
72A8  3D          00190        DEC A
72A9  32FA71      00200        LD (V3), A
72AC  C29072      00210        JP NZ, S6
72AF  2AF771      00220        LD HL, (V1)     ;BOTTOM SCAN OF PREVIOUS
                                               POSITION
72B2  3AF971      00230        LD A, (V2)      ;NO. OF BYTES PER SCAN
72B5  47          00240        LD B, A
72B6  3E00        00250        LD A, 0         ;XOR A WOULD HAVE THE SAME
                                               EFFECT
72B8  77          00260 NEAR   LD (HL), A      ;BLANK THE BYTE
72B9  2B          00270        DEC HL          ;ONTO NEXT BYTE
72BA  05          00280        DEC B
72BB  C2B872      00290        JP NZ, NEAR
72BE  C9          00300        RET
71F7              00310 V1     EQU    71F7H
71F9              00320 V2     EQU    71F9H
71FA              00330 V3     EQU    71FAH
7000              00340 S0     EQU    7000H
0000              00350        END
00000 TOTAL ERRORS

NEAR    72B8  00260     00290
S0      7000  00340     00120
S6      7290  00110     00210
V1      71F7  00310     00110 00130 00140 00220
V2      71F9  00320     00150 00230
V3      71FA  00330     00180 00200
```

SPECIFICATIONS S6 — Spectrum.
GENERAL DESCRIPTION: Shifts the scans in a rectangle on the screen one scan up. That makes any figure in that rectangle appear to rise. The lowest scan on the initial rectangle will be re-set (=0=paper). The previous contents of the top scan of the new rectangle will be lost.
ON ENTRY: V1 — a 2-byte variable at 71F7H and 71F8H — must point to the scan above the top right of the figure in screen memory. V2 — a 1-byte variable at 71F9H — must hold the number of bytes per scan, or the width, of the rectangle. V3 — a 1-byte variable at 71FAH — must hold the number of scans, or the height, of the rectangle. S0 — down a scan — must be in memory at 7000H.
ON EXIT: The rise is performed. V1 and V3 have their contents destroyed.
USES: A, B, C, D, E, H, L, V1, V2, V3.

You many have noticed that each of the subroutines so far is fairly short and there have been ways of testing each subroutine via Basic before we moved to the next stage. That is generally good practice. Beginners in machine code try normally to write a huge whole program which grows and grows with many jumps and scarcely any subroutines.

One difficulty with such programs is that it can be difficult to pinpoint a particular error. If the program can be broken down into stages and each stage or subroutine tested and documented separately, the frustrations of debugging are reduced. Typically the main calling routine can be left in Basic during most of the development. If speed demands it, that calling routine can be converted into machine code as the last job.

Logically, having devised routines to enable the smallest horizontal movement, we should turn to the smallest vertical movement — shifting up or down by one scan at a time. Horizontal movement involved moving the bits within each byte but vertical movement will involve copying whole bytes from one scan to another.

If you wish to move up the figure we



should start with the top scan of its present position and the scan immediately above that. If we copy the top scan into its new position, we can then copy the next to top scan, and so on down the figure.

If we wish to move the figure down, we should start with the bottom scan of its present position and the scan immedialtely below that. Then we can move up the figure. It is generally true that to move up data in memory you should start at the top of both the present position and the new position.

To move down data in memory, you should start at the bottom of the present and the new position. If there is any overlap between the present and the new position and you get this the wrong way round, you will lose some of the data and one portion of the data will be repeated in the position where the lost data should be.

In the March issue there was a definition of the opcode LDIR. That repeating instruction required BC, DE and HL to be set before it could be used. BC had to contain the number of repeats required or the number of bytes in the block of data. HL had to point to the bottom of the present position of the block of data to be moved. DE had to point to the bottom of the new position for the block of data to occupy.

There is another instruction called LDDR. It is similar to LDIR except that HL and DE have to point at the top of the present and new positions. Once again BC has to contain the number of repeats required.

LDDR works by transferring the byte of data held at the address pointed to by HL to the address pointed to by DE. It then decrements HL and DE, whereas LDIR increments. Then it decrements BC. If that causes BC to go to zero, the instruction is terminated. Otherwise the PC or program counter register is decremented twice and hence the instruction is repeated.

Thus the rule for shifting data in internal memory is if you are shifting up data in memory, use LDDR and if you are shifting down data in memory, use LDIR. Those two instructions are very useful. They can be used for inserting or deleting records from the middle of files, words from the middle of text, or blocks from the middle of look-up tables.

In the case of routines S6 and S7, shown in boxes one and two, it is not crucial whether we use LDIR or LDDR. That is because each scan has to be transferred separately. What is crucial is the order in which we tackle the scans. Since LDIR was used in S3, the routine to show a figure of any size, this time LDDR, is used in S6 and S7. S6 is a routine to shift up a scan and S7 is a routine to shift down a scan. Because LDDR is to be used, we must start at the right-hand corner of any figure. If LDIR was used, since HL and DE would be incremented after the transfer of each byte, we would have to start at the left-hand corner.

I mention the starting position par-

continued on page 88

Box 2.

```
72C0               00100        ORG 72C0H
72C0  2AF771       00110 S7     LD HL, (V1)    ;LOCATION IN SCREEN MEMORY
72C3  CD0071       00120        CALL S2        ;UP A SCAN
72C6  ED5BF771     00130        LD DE, (V1)    ;NOW DE POINTS TO SCAN
                                               BELOW HL
72CA  22F771       00140        LD (V1), HL    ;NOW V1 IS 1 SCAN UP
72CD  ED4BF971     00150        LD BC, (V2)    ;C=NO. OF BYTES PER SCAN
72D1  0600         00160        LD B, 0        ;REMOVE RUBBISH FROM B
72D3  EDB8         00170        LDDR
72D5  3AFA71       00180        LD A, (V3)     ;NO. OF SCANS LEFT TO MOVE
72D8  3D           00190        DEC A
72D9  32FA71       00200        LD (V3), A
72DC  C2C072       00210        JP NZ, S7
72DF  2AF771       00220        LD HL, (V1)    ;TOP SCAN OF PREVIOUS
                                               POSITION
72E2  3AF971       00230        LD A, (V2)     ;NO. OF BYTES PER SCAN
72E5  47           00240        LD B, A
72E6  3E00         00250        LD A, 0        ;XOR A WOULD HAVE THE SAME
                                               EFFECT
72E8  77           00260 HERE   LD (HL), A     ;BLANK THE BYTE
72E9  2B           00270        DEC HL         ;ONTO NEXT BYTE
72EA  05           00280        DEC B
72EB  C2E872       00290        JP NZ, HERE
72EE  C9           00300        RET
71F7               00310 V1     EQU    71F7H
71F9               00320 V2     EQU    71F9H
71FA               00330 V3     EQU    71FAH
7100               00340 S2     EQU    7100H
0000               00350        END
00000 TOTAL ERRORS

HERE    72E8  00260    00290
S2      7100  00340    00120
S7      72C0  00110    00210
V1      71F7  00310    00110 00130 00140 00220
V2      71F9  00320    00150 00230
V3      71FA  00330    00180 00200
```

SPECIFICATIONS S7 — Spectrum.
GENERAL DESCRIPTION: Shifts the scans in a rectangle on the screen one scan down. That makes any figure in that rectangle appear to fall. The highest scan on the initial rectangle will be re-set (=0=paper). The previous contents of the bottom scan of the new rectangle will be lost.
ON ENTRY: V1 — a 2-byte variable at 71F7H and 71F8H — must point to the scan below the bottom right of the figure in screen memory. V2 — a 1-byte variable at 71F9H — must hold the number of bytes per scan, or the width, of the rectangle. V3 — a 1-byte variable at 71FAH — must hold the number of scans, or the height, of the rectangle. S2 — up a scan — must be in memory at 7100H.
ON EXIT: The fall is performed. V1 and V3 have their contents destroyed.
USES: A, B, C, D, E, H, L, V1, V2, V3.

continued from page 87

ticularly because there are subtle differences between the required contents of V1, the two-byte variable holding the starting position, for S3, S4, S5, S6 and S7. For S3, V1 must point to the top left of the position of the figure in screen memory. For S4, V1 must also point to the top left. For S5 V1 must point to the top right of the position of the figure in screen memory. For S6, V1 must point to the scan above the top right of the position of the figure in screen memory. For S7, V1 must point to the scan below the bottom right of the position of the figure in screen memory.

Those subtle differences mean that, to use the routines so that they act on only those bytes contained in the rectangle of a particular figure, we should have more routines which keep track of where the outer edges of that rectangle are. Such routines would also enable us to ensure that portions of the figure are not able to escape at the edges of the screen. You may already have noticed that you can lose the whole or a part of the alligator by shifting it into the border. Next month's article, the last in the series, will deal with that problem.

The Basic program this month, in box three, is somewhat crude in the values it pokes into V1, V2 and V3 before using the routines. It is arranging for the whole of the screen to shift up, down, left or right because there is no code ensuring that a track is kept of the position of the alligator.

'You can lose the alligator by shifting it into the border'

Immediately after the LDDR instruction on line 170 of S6, there is some code to check whether all the scans have been moved. Since the number of scans left to move is held in V3, that variable is loaded in A. Then A is decremented, to see if we have dealt with all the scans. Instead of jumping on the basis of the zero flag at the point, we store the new value of V3 first. That instruction on line 180 will not affect the flags.

LD instructions have no effect on the flags and it is always safe to store the value of a counter before deciding whether to return once more round a loop. The code from lines 220 onwards sets the bottom scan of the previous position to paper.

All the routines in this series, apart from a completely separate Basic program in box three of the March issue, have been written to fit into a 16K Spectrum. Unfortunately that means that we no longer have room to keep S0, S2, S3, S4 and S5 in Basic data statements as well as the new routines. If you try to add the S6 and S7 Basic data statements to the previous programs you will get an Out of Memory error message.

That is not an insuperable problem, because you can run the previous programs poking the earlier routines into memory and then record them as bytes. S2 — up a scan — will be required; it was shown in the February issue. S1 — January issue — must not be included; it was a test of the relationship between the scans within a standard character and it occupies the same space as S0. Box four with this article details the locations in hex and denary of S0, S2, S3, S4, S5, S6 and S7, together with a brief description of their purpose.

Having poked S0, S2, S3, S4 and S5 into memory, record them by typing SAVE "ALLINIT" CODE 28672,646. Line 20 of the program in box three will LOAD the bytes under that name from tape. The new program allows the previous left and right movements with the "l" and "r" keys and also allows vertical movements if the "u" and "d" keys are pressed.

I hope that many readers are not running only the Basic programs given but are also adapting the routines for their own programs. Bear in mind that, if you wish to move the routines in memory, you will have to adjust the addresses after each absolute jump. If you want complex shapes to move independently but close to each other, you may have to break some of the figures into several rectangles.

John Kerrigan runs courses in Z-80 assembly language. Details from Alligator Data Ltd. 01-674 8512.

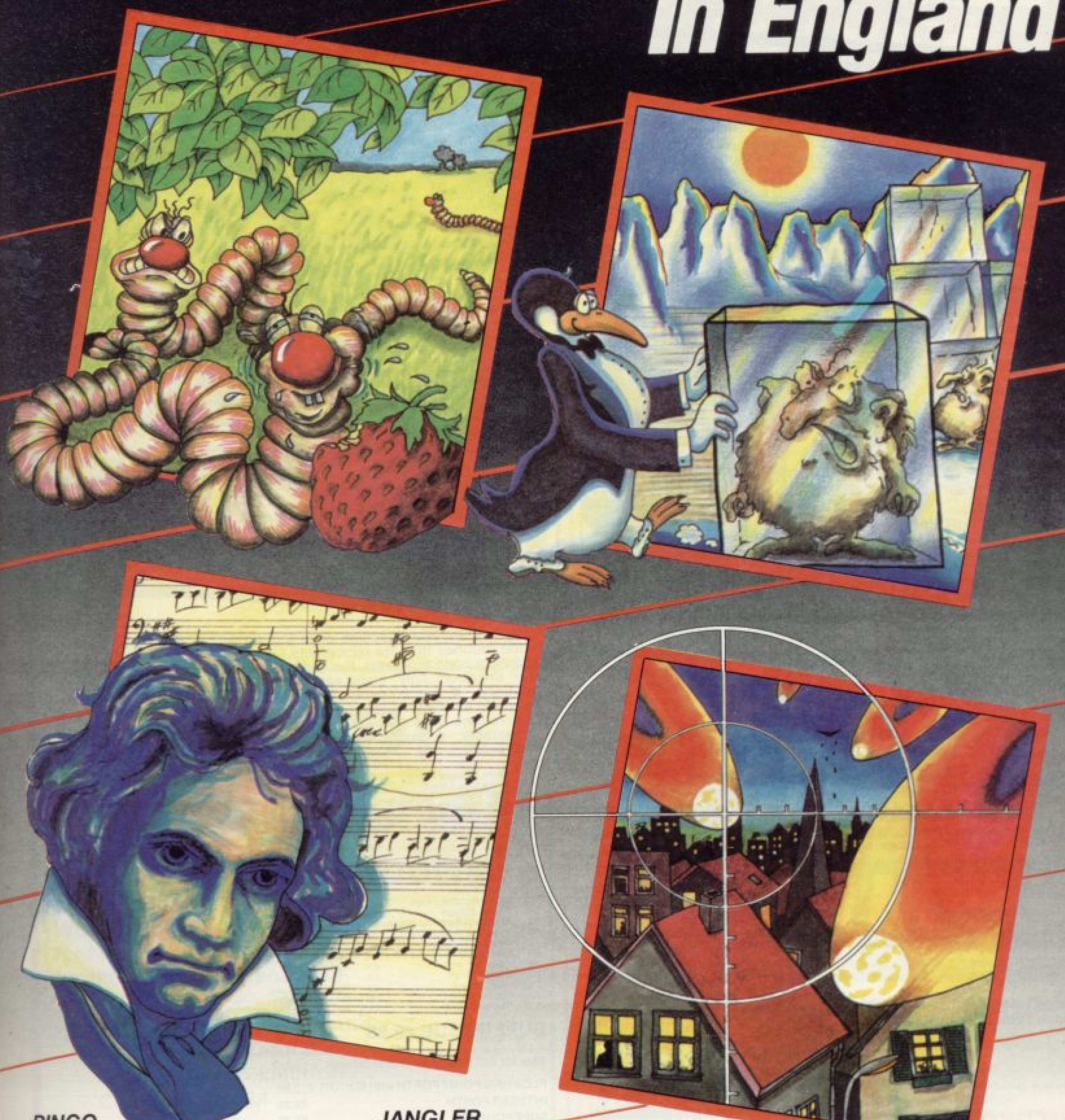
Box 3.

```
  10 CLEAR 28671
  20 LOAD "ALLINIT" CODE
  30 REM INITIAL V1,V2,V3,V4
  40 DATA 10,72,34,112,8,14
  50 FOR A=29175 TO 29180: READ B; POKE A,B: NEXT A
  60 RANDOMIZE USR 29184
  70 REM S6 MACHINE CODE
  80 DATA 42,247,113,205,0,112,237,91,247,113
  90 DATA 34,247,113,237,75,249,113,6,0,237,184
 100 DATA 58,250,113,61,50,250,113,194,144,114
 110 DATA 42,247,113,58,249,113,71,62,0,119,43,5
 120 DATA 194,184,114,201
 130 FOR A=29328 TO 29374: READ B: POKE A,B: NEXT A
 140 REM S7 MACHINE CODE
 150 DATA 42,247,113,205,0,113,237,91,247,113
 160 DATA 34,247,113,237,75,249,113,6,0,237,184
 170 DATA 58,250,113,61,50,250,113,194,192,114
 180 DATA 42,247,113,58,249,113,71,62,0,119,43,5
 190 DATA 194,232,114,201
 200 FOR A=29376 TO 29422: READ B: POKE A,B: NEXT A
1000 PAUSE 0
1010 IF INKEY$="r" THEN GO SUB 1500
1020 IF INKEY$="l" THEN GO SUB 1600
1030 IF INKEY$="u" THEN GO SUB 1700
1040 IF INKEY$="d" THEN GO SUB 1800
1050 GO TO 1000
1500 POKE 29175,0: POKE 29176,64: POKE 29177,192: POKE 29178,32
1510 RANDOMIZE USR 29232: RETURN
1600 POKE 29175,31: POKE 29176,64: POKE 29177,192: POKE 29178,32
1610 RANDOMIZE USR 29280: RETURN
1700 POKE 29175,31: POKE 29176,64: POKE 29177,32: POKE 29178,191
1710 RANDOMIZE USR 29328: RETURN
1800 POKE 29175,255: POKE 29176,87: POKE 29177,32: POKE 29178,191
1810 RANDOMIZE USR 29376: RETURN
```

Box 4.

S0	7000H to 7021H	28672 to 28705	Down a scan
Fig	7022H to 7091H	28706 to 28817	Alligator figure
S2	7100H to 711DH	28928 to 28957	Up a scan
V1-V4	71F7H to 71FCH	29175 to 29180	Variables
S3	7200H to 7225H	29184 to 29221	Show figure
S4	7230H to 7254H	29232 to 29268	Shift right
S5	7260H to 7284H	29280 to 29316	Shift left
S6	7290H to 72BEH	29328 to 29374	Shift up
S7	72C0H to 72EEH	29376 to 29422	Shift down

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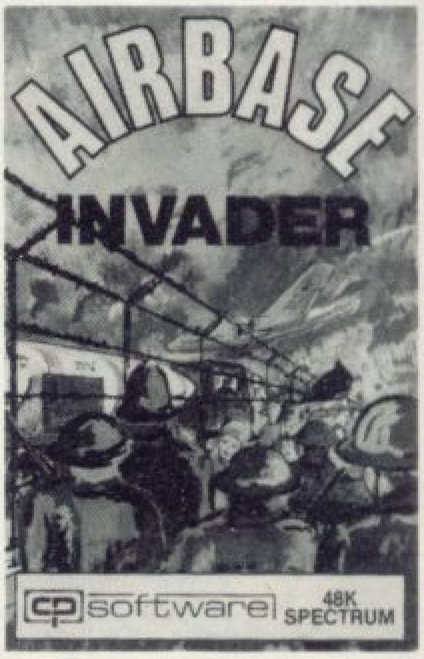
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50. Program to Upper Case
51. Program to Lower Case
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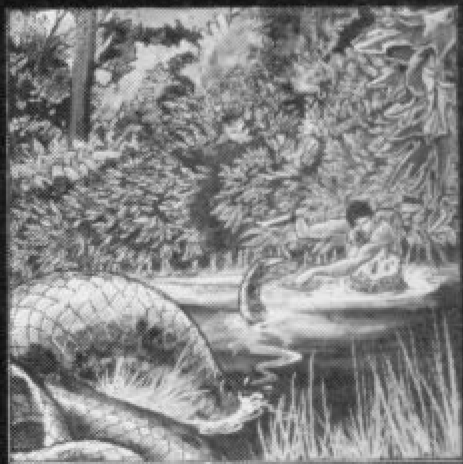
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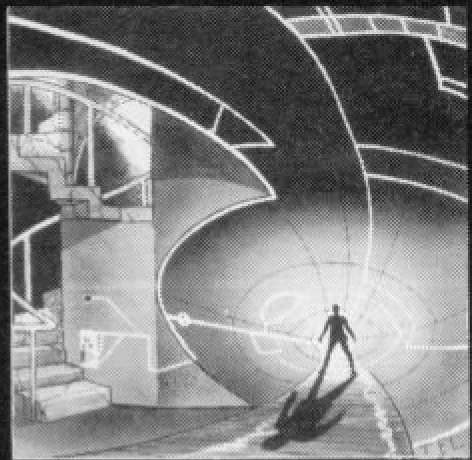
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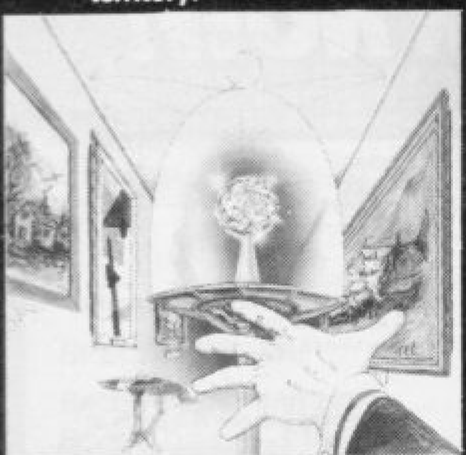
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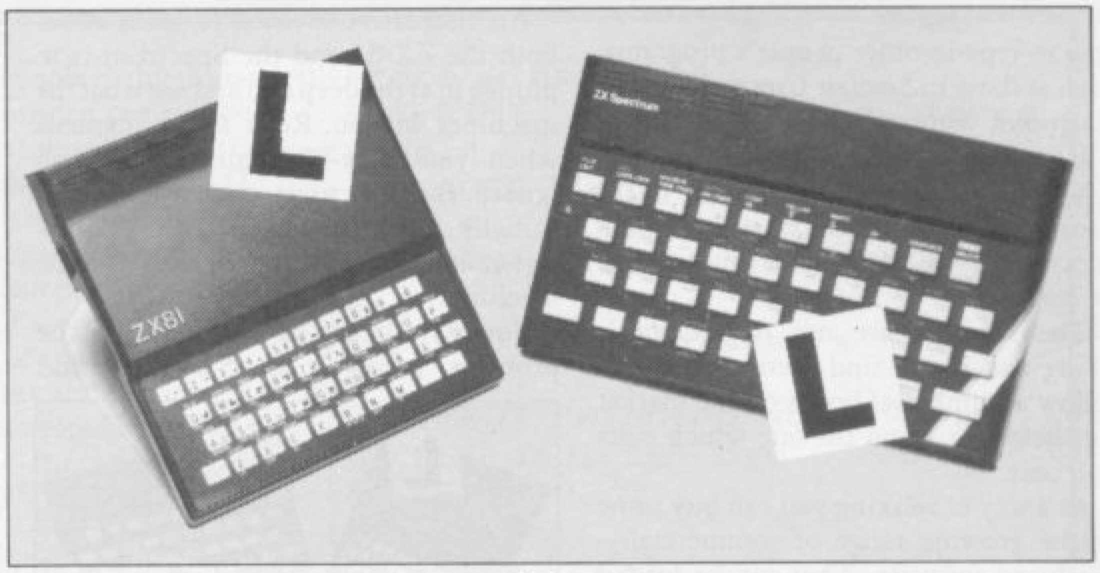
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GLOSSARY

Basic — Beginners' All-purpose Symbolic Instruction Code. A programming language resembling English which is used by beginners because most popular microcomputers have it as standard.
Bug — an error in a program.
EPROM — Erasable Programmable Read-Only Memory. Semi-permanent storage. Information is not erased if the power is turned off in the computer. Programs can be erased by subjecting the memory chips to ultra-violet light. The memory can then be re-programmed using an electrical device called an EPROM blower.
Interface — RS232 and Centronics. A device which enables other computers or add-ons, such as printers, to be connected to the computer. It converts non-standard signals from add-ons to the standard signals of the computer in use.
Kilobyte — (K). A measurement of memory size. Most machines use 16K as a minimum but 48K is generally agreed to be necessary for serious work.
Machine code — an electronic pulse code used by the computer to perform functions and communicate with memory and other devices.
Mnemonics — abbreviated instructions — for example LD for Load — used in machine language programming.
Motherboard — an external printed circuit board which is used like a multi-way plug planner. It enables other printed circuit boards, such as graphics boards and colour boards, to be slotted-in.
Port — a link to the outside world which can be used by programs and the computer.
PCB — printed circuit board. A board which has on it the electronic circuits of the computer.
RAM — Random Access Memory. Information and programs can be stored in this type of memory as electronic pulses which conform to a set of numbers — machine language — in which programs are represented in the computer. When the power is turned off the information will be lost.
ROM — Read Only Memory. Information stored in this type of memory is not lost when the power is switched off.
Software — programs which control the operation of the computer.
Syntax error — a bug caused by incorrect use of a programming language.



Our easy-to-follow guide for new owners

The basic route to a habit-forming hobby

BUYING a Sinclair machine can be the start of a life-time's obsession with home computing. It is easy, however, to become discouraged if everything does not go according to plan from the beginning.

For those with only a little knowledge of computers and their capabilities, the best way to approach the machines is to abandon any ideas for special uses. While the 48K Spectrum is big enough for simple uses in small businesses, the range of Sinclair computers does not contain machines for major uses. It is better to become accustomed to the many facilities and then decide how you wish to use them.

Begin by unpacking your machine, overcoming your surprise at its size and weight and, following the manual, set up the system. If you cannot get the K on the screen, check that everything is plugged into its correct socket and re-set the machine by pulling-out the power plug for one second and try tuning-in again. If still nothing appears, check the power supply unit by shaking it. If it rattles, return it. If it is satisfactory, check your system with that of a friend.

If you have a Spectrum you will have received an introductory booklet which explains what the computer can do and giving detailed instructions on how to set it up. Also included is a fault-finding guide.

Once the K appears you are ready to begin learning about your machine. It can prevent family arguments if you can afford a separate television set for your system. It also makes life easier if you find somewhere to leave your equipment set up permanently. You will find that a few power sockets are needed and a four-way block connector on a short length of extension cable will help to tidy trailing leads.

When using a Spectrum, a television set has to be more finely-tuned than when using a ZX-81 because of the added dimension of colour. If the set is not tuned properly, the colours will look hazy instead of sharp and clear. If no colour can be seen when it is switched on, the power supply or the television set may be at fault.

Some users have experienced some difficulty with some television sets, which include Hitachi, Grundig and Toshiba. Sets which many people have found compatible include the Sony Trinitron, Fidelity and Ferguson. Recent changes in the ULA should make more sets compatible.

The manuals are written in great detail and are reasonably easy to follow. Some of the chapters may not seem immediately relevant but it is worthwhile reading them as you might miss something important.

Patience is needed at that stage to learn the ways in which the computer will accept information. It is tempting to try to enter programs before you are ready but that is likely to lead to errors. For example, words like AND, THEN and AT should not be typed-in letter by letter.

By the time you have reached chapter 11 in the ZX-81 manual and chapter 19 in the Spectrum manual you should have accumulated sufficient knowledge to be

continued on page 96

continued from page 95

able to type-in other people's programs, such as those in *Sinclair User* and *Sinclair Programs*, without too much difficulty.

It is important when using the ZX-81 that it is not jolted. Some of the connections can easily work loose and everything which has been entered will be lost.

The manuals are not to everyone's liking and if you find them difficult to follow a number of books on the market can help you. Find the one which suits you best.

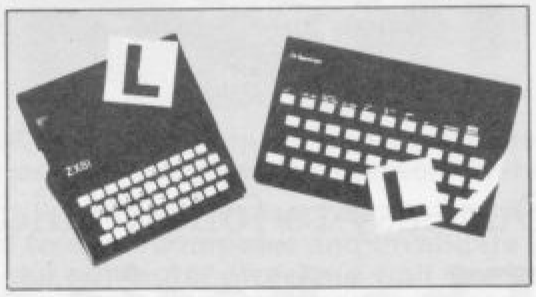
As a way of relaxing you can buy some of the growing range of commercially-produced software. That can be loaded directly from cassette but make sure that your machine is big enough to take the tapes you buy.

For the ZX-81 there are a few tapes for the unexpanded 1K machine but the majority require the 16K RAM pack. Similarly on the Spectrum most companies are taking advantage of the possibilities provided by the larger 48K machine rather than providing cassettes for the 16K.

The tapes can vary in quality and it is advisable to read the reviews in *Sinclair User* and use your judgment to find the best.

An alternative method to learn about both the ZX-81 and the Spectrum is to plunge in at the deep end and see what the machines will do. Refer to the manuals when you have difficulties. You can ignore the functions and calculations initially and experiment with PRINT statements to obtain the feel of the machines.

You may already have heard about the problem involved in SAVEing and



LOADing your own cassettes. The manual gives detailed instructions but many of the early ZX-81s would not accept tapes from some recorders. That problem is said to have been overcome but there can still be difficulties.

Usually they occur when LOADing tapes recorded by other people. One simple method to overcome this is to wind the tape to the middle of the program and type LOAD "" followed by NEWLINE; then increase the volume of the recorder slowly with the tape running until the television screen shows four or five thick black bands. If you then re-wind the tape, the program should LOAD normally.

LOADing and SAVEing on the Spectrum is much easier and faster than the ZX-81. One difference is that when SAVEing on the Spectrum the LOAD lead must be disconnected either at the recorder or the Spectrum.

Finally, a health warning. Apart from any practical uses, computing with your Sinclair machine can be a very entertaining hobby and is almost certainly habit-forming. You may easily find yourself crouched over your machine, red-eyed, in the early hours of the morning thinking that in another five minutes you will solve the problem. Try to break that habit by getting into the fresh air and meeting other Sinclair users.

By obtaining a Sinclair computer you find that you have joined a not very exclusive club with many thousands of members, many of whom would be only too happy to advise you if you have difficulties.

Make sure of your regular copies of *Sinclair User* and *Sinclair Programs* and you can be guaranteed many happy hours.

SNAP

SNAP IS A GAME for two players in which the screen and border continually change colour. When the colours match, player one should press 0 and player two should press 1. The player to press first gains a point but a point will go to the opponent if you press at the incorrect time. Written for the 16K Spectrum by Bill Lythgoe of Shelvington, Wigan.

VARIABLES used by the program:

a$	1st player's name
b$	2nd player's name
a	1st player's score
b	2nd player's score
w	Winning score
bo	Border colour
pa	Paper colour
n	used to vary the note in BEEP statements
10—60	Prints the opening titles
70	Waits for a key to be pressed
100—120	Input the players' names and winning score
130	Sets players' scores to zero



```
   10 PRINT AT 1,12; FLASH 1;"!SN
AP!"
   20 PRINT ''"This game is for 2
 players."''"The screen and its
border keep  changing colour. Wh
en they are  both the same colou
r,the first  player tries to pre
ss "; FLASH 1;"1"; FLASH 0;'"The
 second player tries to      pre
ss "; FLASH 1;"0"
   30 PRINT '"If you press first
you get a    point."
   40 PRINT "If you press at the
wrong time  your opponent gets a
 point."
   50 PRINT '"First to the winnin
```

150 As the paper colour keeps changing, this command ensures that anything printed can still be read. If the paper is dark, the ink will be white; if it is light, the ink will be black. See page 111 of the manual

170—180 Picks random paper and border colours and clears the screen to those colours

190—200 Prints the players' names and scores

210 Pause for a random amount of time

220—250 If either player is pressing a key and the colours are the same, their score is increased and printed. If the colours are not the same, their opponent's score is increased

260 Clears the message printed in lines 220—250

270—280 Alters the value of n and limits it to 13

290—300 If either of the players has reached the winning score, print it and GOTO the end of game routine

310 GOTO start of game

500—530 Print instructions to play again

540 Wait for key to be pressed

550—560 If you have chosen either option, GOTO the correct line. If not, the program will run out of lines and STOP

This is a fairly straightforward game but as it might be used by people who know nothing about computers it should be error-trapped — that is the program should not stop if an incorrect key is pressed. When one player presses a key in lines 220—250, if that is the winning press the program goes to line 500 and waits for another keypress, if the player has not released the key quickly enough the program stops. By adding the new line 500, the program waits for the key to be released before continuing.

```
500 IF INKEY$< >"" THEN GOTO 500
505 CLS
```

Lines 100—120 can also be error-trapped, for example:

```
100 INPUT "1st player's name?"
;a$: IF a$="" THEN PRINT AT 20,4
;"You must enter something": GOTO 100
105 CLS
```

There is more error-trapping you can do — that is for you to decide.

If the program is to be used by very young children it would be useful if they had to press only their half of the keyboard rather than one key. For example, add:

```
210 PAUSE 50+RND*50
212 LET st=(IN 65278< >255 OR IN 65022< >255
OR IN 64510< >255 OR IN 63486< >255)
214 LET nd=(IN 61438< >255 OR IN 57342< >255
OR IN 49150< >295 OR IN 32766< >255)
216 IF st=1 AND nd=1 THEN PRINT AT
10,12;"TIE": FOR t=1 TO 100 NEXT t: CLS: GOTO
160
```

If you have an Issue 3 Spectrum, alter all the 255s to 191. Alter the beginning of the following lines to:

```
220 IF st=1 AND . . .
230 IF nd=1 AND . . .
240 IF st=1 AND . . .
250 IF nd=1 AND . . .
```

```
g score wins."
  60 PRINT '"Press any key to co
ntinue."
  70 PAUSE 0
  80 CLS
 100 INPUT "1st player's name? "
;a$
 110 INPUT "2nd player's name? "
;b$
 120 INPUT "Winning score? ";w
 130 LET a=0: LET b=0
 140 LET n=0
 150 INK 9
 160 BEEP .05,n
 170 LET bo=INT (RND*8): LET pa=
INT (RND*8)
 180 BORDER bo: PAPER pa: CLS
 190 PRINT AT 1,1;a$;AT 2,1;a
 200 PRINT AT 19,1;b$;AT 20,1;b
 210 PAUSE 1+RND*50
 220 IF INKEY$="1" AND bo=pa THE
N  PRINT AT 10,12;"!SNAP!": BEEP
 .1,19: BEEP .7,16: LET a=a+1: P
RINT AT 2,1;a
 230 IF INKEY$="0" AND bo=pa THE
N  PRINT AT 10,12;"!SNAP!": BEEP
 .1,0: BEEP .7,4: LET b=b+1: PRI
NT AT 20,1;b
 240 IF INKEY$="1" AND bo<>pa TH
EN  PRINT AT 10,12;"WRONG!": BEE
P .8,-18: LET b=b+1: PRINT AT 20
,1;b
 250 IF INKEY$="0" AND bo<>pa TH
EN  PRINT AT 10,12;"WRONG!": BEE
P .8,-18: LET a=a+1: PRINT AT 2,
1;a
 260 PRINT AT 10,12;"          "
 270 LET n=n+1
 280 IF n=13 THEN  LET n=0
 290 IF a=w THEN  PRINT AT 2,1;a
;AT 12,1; FLASH 1;a$;" WINS!": P
AUSE 200: GO TO 500
 300 IF b=w THEN  PRINT AT 20,1;
b;AT 12,1; FLASH 1;b$;" WINS!":
PAUSE 200: GO TO 500
 310 GO TO 160
 500 CLS
 510 PRINT ''"To play again with
 the same two players press s."
 520 PRINT ''"To play with diffe
rent players  press d."
 530 PRINT ''"To stop press any
other key."
 540 PAUSE 0
 550 IF INKEY$="s" THEN  GO TO 1
20
 560 IF INKEY$="d" THEN  GO TO 1
00
```

AMAZE

A MAZE is a beginner's program written for the 1K ZX-81 by Antony Joyner of Emsworth, Hampshire. Once LOADed the program will auto-run and draws some interesting patterns which can be printed of connected to a printer. After the pattern has been completed you can press any key to see another pattern. Do not break into the program as it will have to be LOADed again.

```
  10 FOR G=1 TO CODE "-"
  20 LET A=RND*CODE "="
  40 FOR F=VAL "1" TO A
  50 PLOT G,F
  55 PLOT U-G,F
  56 PLOT U-G,U-F
  57 PLOT G,U-F
  60 PLOT F,G
  65 PLOT F,U-G
  66 PLOT U-F,U-G
  67 PLOT U-F,G
  70 NEXT F
  80 NEXT G
  90 PRINT AT
Q,(Q+VAL "1");"PRE
SS A KEY"
 100 PAUSE I
 105 CLS
 106 GOTO Q
 107 SAVE "▣"
 109 GOTO Q
```

SEQUENCE

COPY the number sequence as shown by the computer without making mistakes.

Sequence was written for the 16K Spectrum by David Bond of Hornchurch, Essex.

```
   4 DIM s(100): LET x=1
   6 PRINT AT 10,10;"PLEASE WAIT
 ";AT 12,2;"SEQUENCE BEING CALCU
LATED"
  10 FOR i=1 TO 100
  20 LET s(i)=INT (RND*4)+1
  30 NEXT i
  35 CLS
  40 PRINT AT 8,6;"ME";AT 8,16;"
YOU"
  60 PRINT AT 5,9;"SEQUENCE"
  90 PRINT AT 10,6;"1234";AT 10,
16;"1234"
  95 INPUT "Press Enter To Start
 ";z$: PAUSE 50
 100 FOR i=1 TO x
 110 LET a=s(i)
 120 PRINT AT 10,5+a; INVERSE 1;
; INK a;a
 130 BEEP .8,a
 140 PRINT AT 10,5+a;a
 150 NEXT i
 170 FOR j=1 TO x
 180 LET u=CODE INKEY$
 190 IF u=0 THEN  GO TO 180
 200 LET u=u-48
 201 IF u>4 OR u<1 THEN  GO TO 3
00
 210 PRINT AT 10,15+u; INVERSE 1
; INK u;u
 220 BEEP .8,u
 230 PRINT AT 10,15+u;u
 240 IF u<>s(j) THEN  GO TO 300
 245 NEXT j
 250 FOR q=0 TO 300: NEXT q
 260 LET x=x+1
 270 GO TO 100
 300 PRINT AT 13,10;"WRONG";AT 1
7,7;"YOU MANAGED ";x
 310 BEEP .1,-12: BEEP .8;-13: B
EEP .2,-12
 320 INPUT "ANOTHER GO (y/n) ";a
$
 330 IF a$="N" OR a$="n" THEN  S
TOP
 340 RUN
 350 SAVE "Sequence" LINE 340
```

Trapping the errors will ensure first-time running

THE FIRST error code encountered by most Sinclair users is the flashing "S" on the ZX-81 or "?" on the Spectrum, which indicates a syntax error in a sentence. Experience and the manual soon show that it is caused usually by typing-in a keyword letter by letter, or by bad punctuation, for example omitting a semi-colon or an inverted comma.

The most frequently-occurring error code is "2" — variable not found. A variable is a letter which has been given a numeric value. When you enter "LET a=2" you are defining a variable. Error code 2 results when the computer reaches a variable in the program to which you have so far given no value.

Check the line which the computer specifies. If it is your program, give a value to the variable or remove it. If you are copying the program, look back in the listing to see which line you have missed.

Although the majority of error codes are explained adequately in the manuals, the report "B-Integer out of range" can be confusing. An integer is a whole number — 1 is an integer, 1.5 and 1½ are not. That code occurs most frequently when you try to print something beyond the limits of the screen.

PRINT AT 0,31; "a" is acceptable and will print a letter "a" at the top right of the screen. PRINT AT 0,32; "a" would not be possible. The integer 32 would be out of range, resulting in error code "B". That would also happen if the computer were instructed to PRINT AT 0,31;"ab". It would still be trying to print a character beyond the limits of the screen.

That error is more difficult to detect if variables have been used as co-ordinates and your character, or series of characters, is being printed in varying positions. If the instruction PRINT AT 0,x;"a" produces report code B, make sure that the value of x never increases beyond 31.

On the Spectrum "B-integer out of range" is also often found when you are POKEing-in user defined graphics. The biggest number which can be POKEd-in this case is 255 or BIN 11111111. In that case the error code will occur in the line containing the POKE statement. In most cases, though, the error will have occurred in one of the DATA lines in the program.

A very frequent error code produced on the Spectrum is "E-Out Of Data". That will occur in a line containing a READ statement. The error code, though, will have occurred in one of the program DATA lines, which may be nowhere near the READ line. A READ command sends the computer to a DATA line to collect the next piece of DATA contained there. That is often done using a FOR, NEXT loop, especially when graphics are being set up.

FOR n=1 TO 8: READ n will send the computer to the DATA lines eight times, for eight separate pieces of information. If there are only seven pieces of DATA there it will return to the READ line and produce the code OUT OF DATA. When there are several DATA lines they will all have to be checked, because the piece of DATA you have omitted was not necessarily the last.

In some cases the computer will follow the program correctly, without producing an error code, but from the programmer's point of view the program contains an error. In that case BREAK into the program at the moment it goes wrong. That will produce report code 9 and the line on which you have STOPped the program. That method makes it easy to locate the area of the program which contains the error.

Programs which you copy from magazines, books or from friends can be difficult to error-trap because they contain programming techniques which you have not yet learned, or simply because it is often difficult to follow another programmer's logic.

The flashing "S" or "?" indicating a syntax error may appear frequently. In that case check carefully what you have copied. You may not have recognised words such as LN or EXP as keywords.

On the ZX-81 especially it is easy to forget that pressing "π" will produce the word PI.

Make sure that when the "is not equal" sign, "< >" appears in a listing you always enter it as one character and not as "is less than", "<" followed by "is greater than", ">".

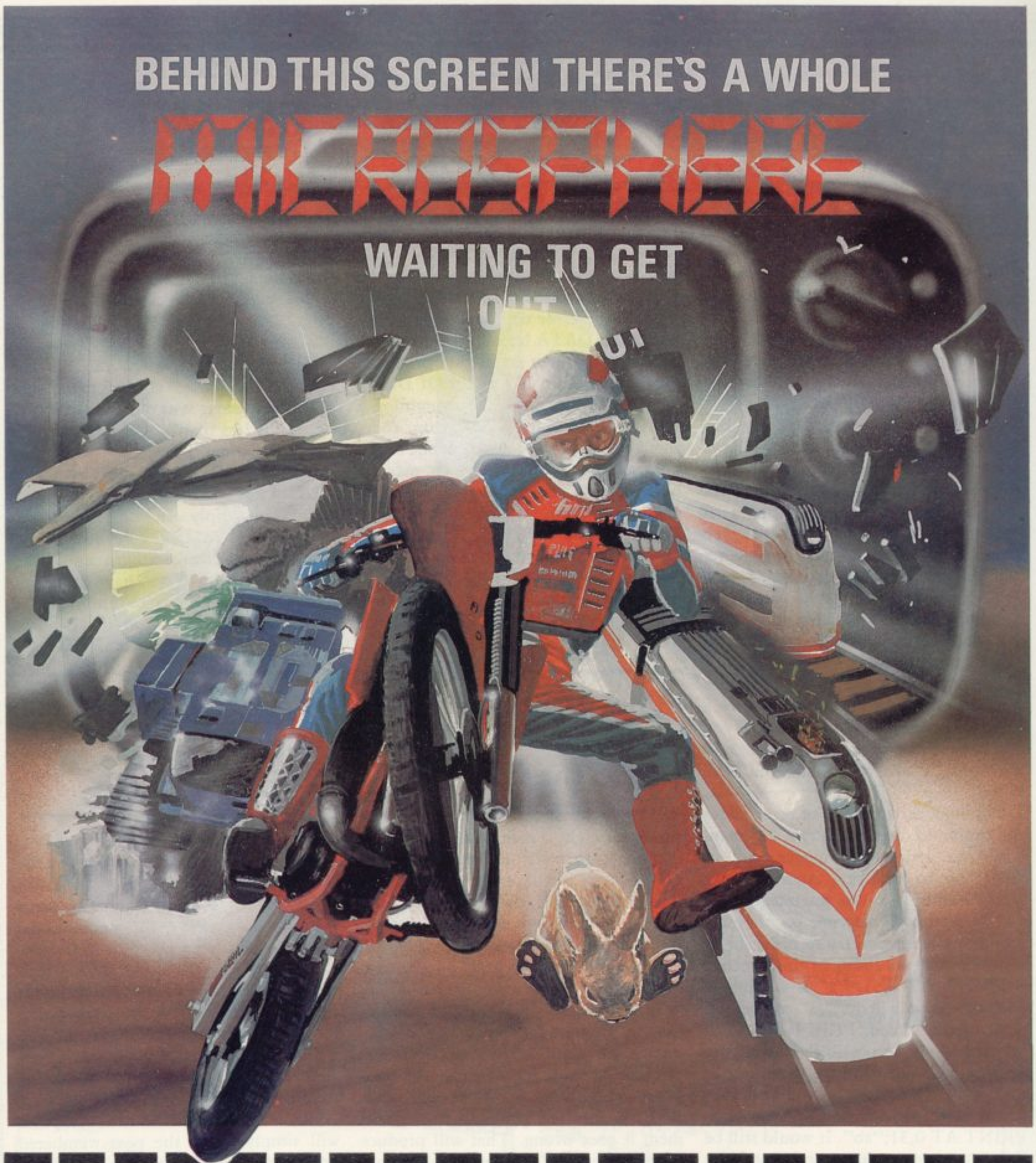
Technical problems can also cause errors in programs. Any alteration to the power supply can cause a program to CRASH. In that case the screen display may change dramatically and using the keyboard will have no effect. The only solution is to unplug your computer and begin again, making sure that your power supply and RAM pack are both connected firmly. That error is caused by the computer and not by the program.

'The error need not be on the line which produces the report; that is simply the line where the computer meets the problem'

Sometimes a program listing in a book or magazine will contain what seems to be a very obvious error. If it contains key words or symbols which are not on your computer, check that it is intended for your machine. Programs for the Spectrum, the ZX-81 and the ZX-80 are not usually directly interchangeable. If a program contains the command GOTO or GOSUB — a non-existent line number — the computer will simply go to the next numbered line after that one. That is a sign that a program has been developed and improved and is rarely an error.

When you have errors in a program, first check the report codes listed in Appendix B of the manual. It may then be necessary to read the appropriate section of the manual. Remember that the error is not necessarily on the line which produces the report code; that is simply the line where the computer meets the problem for the first time.

Always check carefully every line connected with the line containing the error code and the mistake should be easy to locate.



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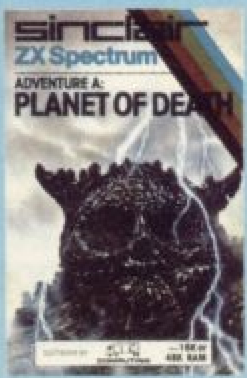
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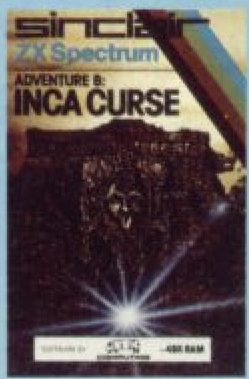
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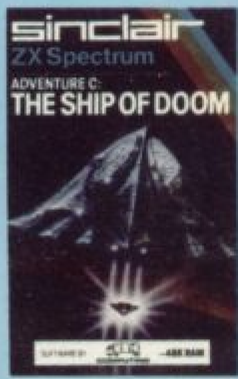
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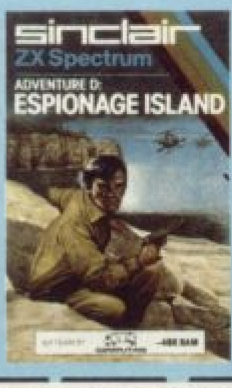


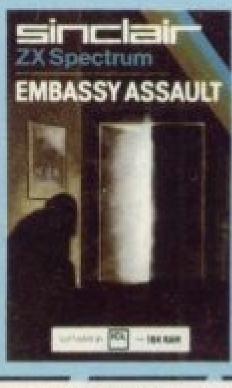
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Rock band Mensana is making sounds with the Spectrum. John Gilbert talks to the group and opens the musical box.

New ROM antics

FROM OUTSIDE, Studio 15 looks uninspiring and not like the place where a new development in music technology is being tried.

The studio, in West Acton, London, lies behind buildings owned by a group of electronics companies and if you walk along the road from West Acton underground station you might not give it a second glance. Yet it contains the haunt and rehearsal room of Mensana, one of the most unusual rock bands on the music scene.

The five members of the group are all long-established members of Mensa, the organisation chaired by Sir Clive Sinclair to which only people with high intelligence quotients can belong and, stranger still, the group controls the sounds it makes using a 48K Spectrum.

The band members are shy about their IQ figures. Barry Conner, the main spokesman, explains why the other musicians are as guarded about the IQs as they are about their ages.

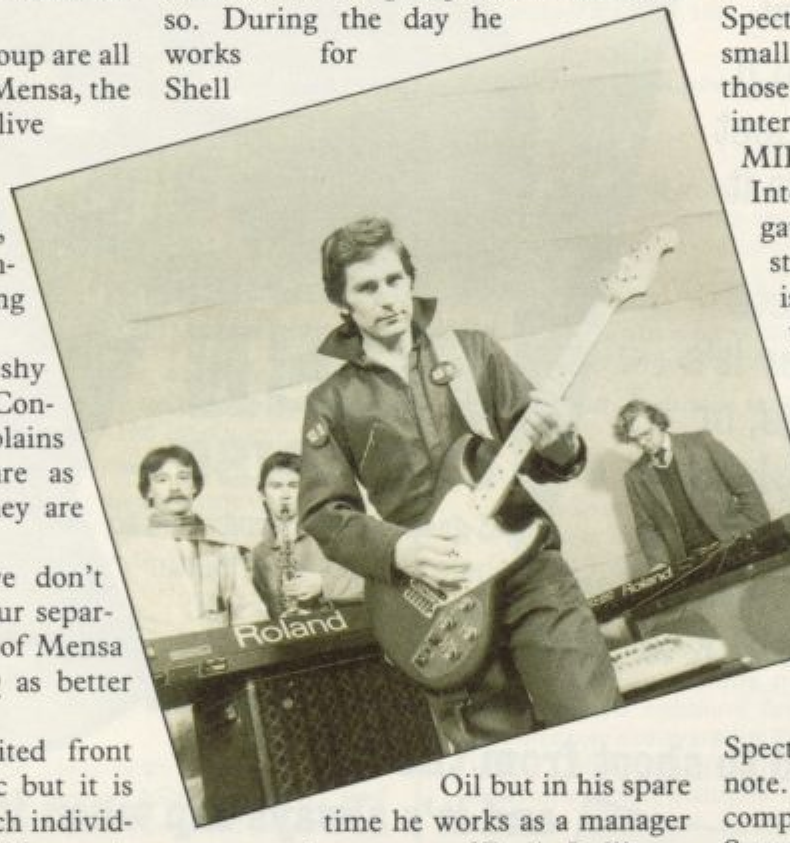
"We are a group and we don't think we should talk about our separate IQs. We are all members of Mensa but we don't regard one IQ as better than another."

They may present a united front while they are making music but it is easy to see the character of each individual as soon as you meet them. Conner is a good example. He plays guitar and synthesiser but his full-time job has nothing to do with music of any kind. He is a London bus driver on route 52 from Victoria. From the start he is clearly the leader and ideas man, although he is in no way a dictator. His fellow members are happy with that.

Greg Houlgate is another guitarist and his full-time job is just as unusual as playing for Mensana. He has launched a board game. He says: "The game is called G-1 and it takes place in a space scenario. I have my own company which markets the game and it is doing very well. I even have badges which promote the product."

Chris Tusheer is the funny man of the group. He says he is on "keyboards and valium". At the moment he is taking a TOPS electronics course. He has a great interest in the technical side of Mensana's music as well as being a music-maker.

At 24, Steve Oglevie is the youngest member of the group to play a traditional instrument. He can play a range of instruments, including saxophone, guitar and even keyboards when the other members of the group allow him to do so. During the day he works for Shell Oil but in his spare time he works as a manager and presenter of Radio Lollipop, a hospital radio service.



He says: "It is all very interesting. I have my own show and I also work behind the scenes. We produce all kinds of shows and discos for children's charities."

The most important member of the band, from the technical point of view, does not play an instrument for Mensana, although he can work wonders with a church organ. Rupert Goodwins created the interface for the Spectrum on which Mensana bases its musical act. Goodwins says:

"I have a great interest in music which, because of the interface for the Spectrum, has been combined with my interest in electronics. I would not say that either one of my interests features more strongly than the other."

Electronics and computers feature large in Goodwins' life, as he is training at Marconi for a year, after which he will go to university. He also works on Prestel and Micronet 800 as a Micromouse on the systems clubs pages.

Goodwins may be the technical expert behind Mensana, and a young one at that, but the real star of the electronic show is Upstream, an interface for the Spectrum which will be a blessing to small and large rock groups alike. For those who are in the music industry, the interface would be better known as a MIDI — Musical Instrument Digital Interface. The MIDI interface, Houlgate explains, is a music industry standard. Its operation is simple. It is attached to the Spectrum and to the other instruments so that they can input music to the computer through the interface as digital signals. The signals can then be altered by the operator at the computer and output to other instruments the group is using.

For the technically-minded, Houlgate says that each note played by, say, a synthesiser can be put into the Spectrum, using three bytes for each note. The tune can then be stored in the computer memory or on cassette tape. Several tunes, using instruments, can be input and stored in that way and the sounds all of them contain can be merged so that a sound-track is made.

It would be possible, using the interface in that way, to produce an instrument track sounding like a full orchestra. With the development in synthesiser technology it should also be possible to add singers, something Mensana does not need in machine or human form.

As well as being able to save and merge tunes produced by various interfaces, Upstream can also alter the nature of the notes entering the Spectrum. It is possible to transpose the keys in which music is produced to make them either higher or lower. It is also

possible to produce special effects on a sound-track, such as echoing. It seems as if there is nothing the interface cannot do. A black box which is about twice the size of a Spectrum power supply, it contains nothing but a few wires and microchips. Houlgate says:

"That is one of the great advantages of Upstream. Until now MIDI interfaces cost a great deal of money and to produce a set-up such as the one we have would cost thousands of pounds. Our interface is cheap to produce and easy to manufacture. It will mean that groups which cannot afford expensive equipment will still be able to produce music using the MIDI standard."

Although the interface can accomplish an amazing number of feats for a musician, Goodwins insists that it did not take much time to develop and get working. He says: "We started planning it last August and it was more or less finished by the beginning of this year. I took about two weeks to do the development work on the software.

The interface will benefit Mensana immediately. After the group's appearance on the BBC science programme *Tomorrow's World*, it has been featured in the music press and has also been approached by record companies to produce an album. Conner says:

"If we produce an album, Upstream would be useful. We could record the tracks for each instrument separately, using the interface and storing the results on tape. We could then take the tape to the record company and have it mix the tracks on its master tape."

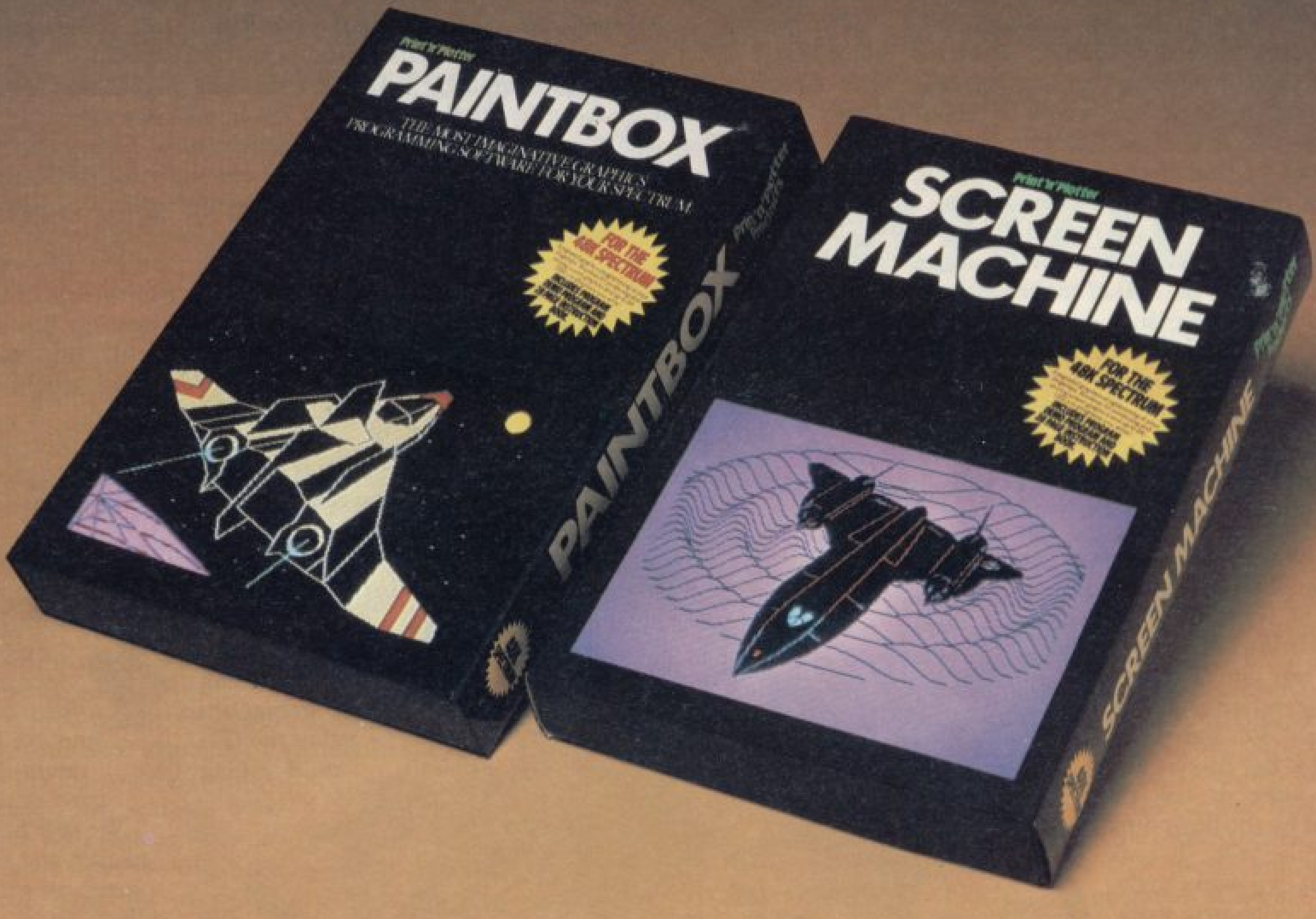
Using Upstream in that way would mean that fewer mistakes are made in creating a master tape from which a record can be cut and released. Record company studios are expensive to operate, so the fewer mistakes made the better. If the tracks for an album were already recorded using Upstream, there would be no nervous tension for the groups involved and only one run-through of a particular track would be necessary.

So far as the future of Upstream and Mensana is concerned, Goodwins plans to develop the interface even more. He says:

"Upstream can be adapted to run on other microcomputers but I don't think we will be doing any work for other micros except the QL. I can increase the storage space for tunes using the QL and use its multi-tasking ability to good effect. We will have to wait and see until we get a QL."



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Contents

On this page we publish the best from our post-bag; overleaf Mike Wright takes two financial packages through their paces.

SINCLAIR BUSINESS USER

May 1984

Why the lack of serious software?

I READ with considerable interest the recent correspondence complaining about the lack of serious applications software for the 48K Spectrum. My experience might be of interest.

I am a consulting engineer who recently retired early. On retirement I bought a Spectrum to assist me in the odd items of part-time work which I undertook from time to time and also to keep my mind active by tackling some of the programming problems I never had time to solve when in full-time employment.

My most recent program is, to my mind, a very good one for the analysis of rigid jointed frames which can handle large frameworks of up to about 60 joints and 100 members, and including automatic accommodation of member loading. I am now extending it into a grillage analysis for bridge decks.

I wrote to many software houses offering it and other programs I have written but received only rare responses. Such responses took the form that the programs were too specialised, were aimed at too small a market, but if I had written any original games with plenty of graphics they might be interested.

My view is that if I had wanted to play space invader games, using programs bought from software suppliers, I would have bought a more efficient games machine, such as the Atari, and not bothered with what is a very good little computer.

Perhaps, given time, someone might start to produce serious routines for use in serious applications. Perhaps that someone might even be Sinclair Research. After all, people like Hewlett-Packard, Commodore, Apple and IBM, among others, provide such a service to their customers. Why not Sinclair?

W C Carney,
Ryton, Tyne & Wear.

Independent testing

MAY I SAY I am pleased to see the increasing interest shown by your magazine and its contributors in the use of the Spectrum for serious applications?

I suspect that many other owners, like myself, use their computers for solving design or business problems and would welcome software specific to their needs.

I am developing several such programs for use in the field of structural engineering. There seems to be a major bug involved in attempts to market such software, which probably accounts for its noticeable absence.

Say, for instance, a program to design a multi-span reinforced concrete beam was utilised by a purchaser and, subsequent to the building being constructed the program was found to be in error. Who takes the responsibility for the appalling financial loss involved?

I would suggest that the legal profession would be the only ones to gain financially from that conundrum. There seems to be a need for some form of independent testing of programs, followed by the issue of a deemed-to-satisfy certificate which would satisfy the user and writer alike.

D A Ryland,
Selsdon, Surrey.

Program has a lotta bottle

I HAVE written a business program for a local milkman which allows him to store details of 700 customers' accounts. He runs it on his ZX-81 but I also have a version for the Spectrum. Do you know of anyone who would also be interested in it?

I should like to see more business-related programs and features in your excellent publication.

C J Wigg,
Banbury, Oxon.

QL—curiouser and curiouser

I AGREE strongly with two of the reservations expressed by Mike Wright in his review of QL. The first is about the lack of a cassette interface, for there must be a very large number of dedicated Sinclair users who have programs and, probably more important, data on cassettes.

Perhaps it will be possible to interface a ZX-81 or Spectrum with QL via the RS232 and, if so, I hope that an add-on or software firm will get cracking on it promptly. The second objection is that, irrespective of costs, in the absence of some explanation from Sinclair Research of its rationale in the matter, it at first sight seems nonsense to have storage hardware with a unit capacity smaller than even the unexpanded RAM capacity. At the very least it will be inconvenient to have to save the contents of RAM bit by bit on to a series of Microdrive cartridges. There must be something behind the apparent illogicality; could it be that Sinclair Research is already working at an advanced stage on a Winchester which will appear at an amazing decimated price, I wonder?

I should like to add a note of regret that Sinclair abandoned the dark-on-light display which corresponds with text on paper, an endearing feature of the ZX-81.

Ian Leslie, London N10.

A package for the small business

Accounting made simple

THE SMALL Business Accounts program from Willden Services under the Sinclair banner contained some bugs and was quickly withdrawn. The corrected version is now available and is in almost identical packaging to the original.

A comprehensive 32-page A6-size manual includes sections on the arrays and variables and notes for an accountant. The cassette holds a training version of the program on one side and the working version on the other, with only minor differences between the two.

The programs are both driven from a main menu which is split into three sections — Data Entry, Data Access and Special Procedures — see figure one.

In the working program, Option 12 becomes Load Data and Option 13 is not used.

It is worth running the training program several times to get the feel of it before starting. Once loaded, the program prompts for a password and allows two attempts at getting it correct. To change the password the program must be broken into and the variable for the password changed. That is explained in the manual. As a security device it seems about as useful as an open safe.

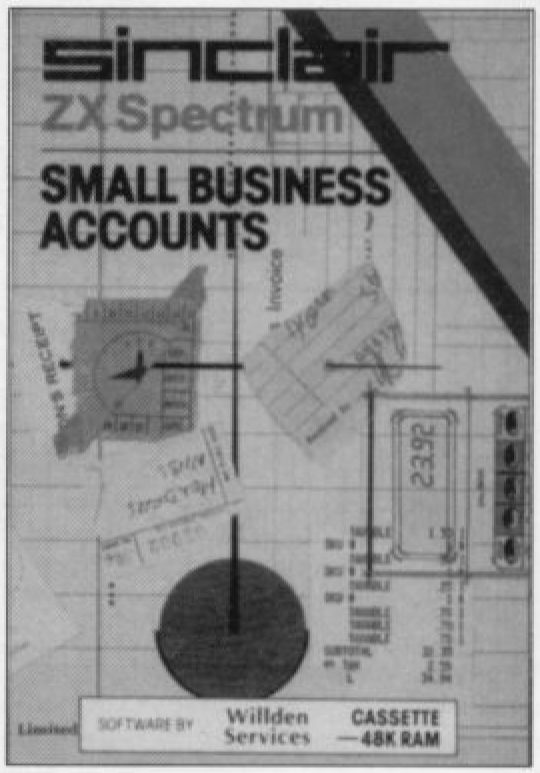
The next prompt is for the date. The format is of the form 1984 FEB 24 rather than the more usual 24/02/84. The program compares that to its in-built financial year — initially set as January & December — and uses it to determine depreciation. Despite requiring capitals the program permits lower-case letters as part of the string. Doing so affects the depreciation routines and gives an erroneous reading. A safety check is built-in with the string displayed and the program prompting for a yes/no response to whether the information is correct.

To get a feel for the program, Option 12, Training should then be taken. Before starting, the user is given a warning that it will erase any data already in memory, with the option of backing out. Once chosen, the option replaces any existing data with fictitious data and presents a balance sheet. The user has the choice either of having the balance sheet printed or of returning to the menu to try the different options.

Option 1 allows entries to be made into the cash book under eight headings — cash sales. own funds, loans, external loans excluding bank overdraft interest received, sales ledger, discount, amounts deducted by customers, settlement of amounts paid in under the sales ledger, sundry used for income which is not subject to VAT or which does not affect stock, and VAT received. An entry under cash sales is also added to the gross sales, the net-sales after 15 percent VAT has been deducted, and a percentage to the gross profit total — initially 30 percent but instructions on how to change it are in the manual.

The cash book out option allows a record to be made of the payments made by the payee and the amount and to assign it to one of nine pre-set allocations. They are the bought ledger, discount — they operate in a similar manner to the cash sales and discount entries in option 1; wages — the net figure after PAYE and National Insurance contributions have been deducted — that program will prompt for them to be entered separately; VAT out — used for settlement of quarterly VAT account; interest out; petty cash — entries reduce the bank account figure and increase the petty cash figure; sundry; PAYE — used for the settlement of PAYE and National Insurance payments; and own use.

The sales invoice option allows the number of invoices entered at one time to be set. The size of the display limits that to a maximum of eight. Once the number of invoices has been set the program prompts for the gross value



and the VAT of each in turn. The amount of VAT due at a rate of 15 percent is also usefully displayed.

The purchase invoice option for invoices from suppliers allows the gross value and VAT to be recorded and the supplier. It also allows the invoice to be attributed to one of 15 accounts. A maximum of six invoices can be entered at one time.

Working in a similar way to purchase invoices, option 5, petty cash, deducts the amounts from the cash-in-hand entry on the balance sheet. When showing the VAT the user is also reminded that it should be zero for wages and postage. The user is asked to confirm the gross amount and VAT before allocating the bill to one of six accounts. If wages is the selected account, prompts are also made for PAYE and National Insurance contributions.

The data access routines provide most of the information auditors are likely to require. The VAT return, option 6, shows the sales and purchase totals inclusive and exclusive of VAT

```
WILLDEN ACCOUNTS PROGRAM
Select a number from this list

DATA ENTRY              DATA ACCESS

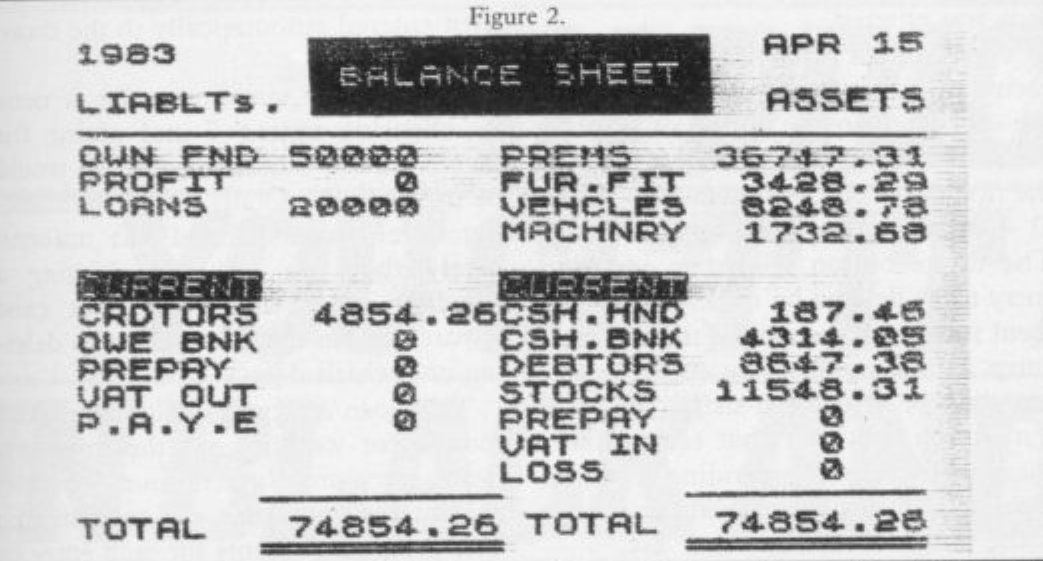
1.Cash Book In          6.VAT Return
2.Cash Book Out         7.Trading a/c
3.Sale Invoices         8.P and L a/c
4.Purch.  ''''          9.Balance Sheet
5.Petty Csh a/c         10.Nom.Ledger

SPECIAL PROCEDURES

11.Cr.Notes             12.Training
13.Initialise           14.Save to tape
15.Close down           16.Stock adjust
```

Figure 1.

Figure 2.



for the current quarter, the whole year and a baseline of how much the user owes the taxman, or vice versa. The trading account shows the opening stock, purchases, closing stock, consumption, sales and gross profit, while the profit and loss account and the balance sheet — figure two — are presented in the traditional manner.

The nominal ledger covers some two-and-a-half screens showing a breakdown of a company's trading into the relevant accounts. That is the only one of the data access routines which does not allow the user the option of taking a copy. A copy can be obtained by pressing N in response to the scroll? question and following it with COPY — the Z key — and ENTER. Once the printer is finished the program can be returned to the same point using CONTINUE — the C key — and ENTER.

There are two differences in the working and training programs. The function of option 12, training, has already been described while the same option on the working program, Load, is self-explanatory as is option 14, save to tape.

Option 13 is spare on the working side but on the training side it is used for the initialisation of the accounts before regular use of the system. Again the user thoughtfully is provided with an escape route and a warning that any previous data will be erased.

The user is then taken step by step through entering the liabilities and assets as they appear on the balance sheet. Next are the prompts for the outstanding VAT figures. If you should be lucky enough for the VAT quarter and your financial year to coincide they will be zero. Once that is done the balance sheet is displayed and the data should be saved to tape before closing the training program. Once the initialisation routine is completed it is impossible to return to any data entry routine without first saving and verifying the data.

The remaining two options are 11, credit notes, and 16, stock adjustment. The credit notes routine deals with the situation when goods are returned, either by you or your customer, and asks for the gross value, VAT and whether a sales or purchase note. If it is a purchase note an allocation to one of the accounts must also be made. The stock adjustment routine allows the user to change the value of stocks, after which a revised balance sheet is shown.

Accounting procedures are something with which all businessmen are familiar to one degree or another. The computerisation of these records is less familiar. One reason is the inability of programs and programmers to meet the multiplicity of criteria required by differing businesses and yet at the same time remain simple.

Willden Services has attempted to overcome that with Small Business Accounts and has succeeded to a remarkable degree.

> 'The program has a high level of error-trapping'

The program also has a high level of error-trapping to avoid the input of obviously ridiculous entries. To achieve the flexibility to meet an individual company's needs it is necessary for someone in the company to have at least a rudimentary knowledge of programming to set some of the variables. Although the manual explains the steps necessary, unfortunately it makes the program a great deal less user-friendly.

Small Business Accounts is available from *Sinclair Research, Stanhope Road, Camberley, Surrey GU15 3BR.*

Budget control

Keeping track of personal expenditure

RICHARD SHEPHERD Software is a company well-known for its range of adventure games. Cash Controller, a home budgeting and banking system written by Richard Shepherd for the 48K Spectrum, is probably the first program written specially as Microdrive-compatible.

The program is designed to keep track of personal expenditure and its breakdown into any one of up to 16 user-definable accounts. It permits transactions to be entered with the date, details and the account. It also allows standing orders to be set up and implemented and will print-out statements. Another feature is the ability to define budget limits for the accounts and to compare them against expenditure.

Once loaded the program displays the master menu: 1, Budget menu; 2, Bank account menu; 3, Mortgage loan calculator; 4, Update password; 5, Save program to cassette; 6, Save program to Microdrive; 7, Delete program; 8, Entry search.

Obviously the majority of use will be from options 1 and 2. To take any option, press the appropriate number key followed by ENTER. If keys are mis-hit the program replies 'INVALID RESPONSE' and the user is left to re-enter the option, except for the odd occasion when the mis-hit keys give a number first then letter combination. In such a case the program crashes and is re-started with GOTO 9900.

Selecting option 1 brings up the budget options menu: 1, Enter new budgets; 2, Update budgets; 3, Print budgets and variances; 4, Breakdown budget actual; 5, Clear all budget details and enter new budgets; 6, Return to master menu.

Enter new budgets allows the user to define the account title using up to 10 characters and set the budget. Although a name is given the accounts are referred to usually by a code number — 1-16 — but it is not shown at that stage. If a mistake is made in the last entry, pressing ENTER moves the cursor back and allows the mistake to be corrected.

continued on page 112

continued from page 111

Return to the budget menu is by pressing xx and ENTER. If you wish to change the budget of an account, option 2 is used. That asks for the budget title and the new amount. Once that is done the program prompts for whether there are any more budgets to be updated.

One of the better features about Cash Controller is the provision for comparing budgets and expenditure. That is done using option 3, which prints the account name, its code number, the budget, the expenditure and the variance, together with the totals for all accounts. A permanent copy can be obtained by pressing Z, and ENTER returns to the menu.

In selecting the Breakdown budget actual option the user is asked for the account to be examined. The program will then display those transactions made on the account, the date, the amount and the balance remaining in the budget.

The same facilities for printing the details exist as for option 3. Option 5 is self-explanatory but beware — there is no escape route. Should you select the option accidentally the budgets are cleared instantly and new ones requested as for option 1.

The Bank Account Options menu is reached by selecting option 2 on the master menu: 1, Enter transactions; 2, Statement request; 3, Clear transaction files; 4, Clear transaction files and set balance to zero; 5, Enter opening balance; 7, Delete standing orders; 8, Return to master menu.

By choosing option 1, transactions can be entered. They consist of the date, the details — e.g. cheque no. or payee name — in a six-character field, the account code and the amount. All amounts are debits unless "credit" is specified — in lower-case only — as the details.

Also worth noting is the fact that a 17th account code of 0 is available if you wish to make an entry without assigning it to a budgeted account.

The transactions do not have to be in date order, nor are they arranged into date order in that section of the program. They are ordered only for the printing of statements in option 2. Before working out the statement the user is asked to enter the starting date and then tomorrow's date, although that could be any date, plus one, at which the statement is to finish.

Once it has those dates the program scans the data for each date in turn looking for any transactions which may have taken place on that day. When one is found it is displayed in the same way as it was entered.

The program scans the whole data for each day in the period. When it finishes the user is given the option of printing the statement — using C — or deleting the first entry on the statement — using D — or continuing with any other key. The delete option allows an incorrect entry to be deleted by obtaining a statement starting at the date of the incorrect entry and using D. The correct entry can then be re-entered using the enter transaction routine. That seems like a complicated way of amending an entry, especially if the one you want to change is the fourth or fifth on that day.

The next two options are similar, in that both clear the transactions and reset the budget expenditure totals to zero, although option 3 keeps the balance brought forward. Selecting either option returns immediately to the same menu. The enter opening balance routine allows the opening balance to be set and to be re-set at any stage in the program should it be necessary. Once the figure has been entered the user is given the choice of backing out and re-entering the correct figure by pressing N, or continuing with Y.



The menu also allows standing orders to be set, using option 6. The user is asked for the date on which the order is to begin and then for the frequency of payments — 1 for monthly, 2 for quarterly, 3 for annually.

Irregular payments must be entered as individual transactions. Prompts are then issued for the details, the account code and the amount. The details are then entered automatically to the transaction data.

Deleting the standing order is done by choosing option 7 and giving the details of the standing order. It would be useful if the details for all the standing orders were printed but unfortunately they are not and deleting a standing order which does not exist apparently has the same effect as deleting one which does.

The loan/mortgage calculator is a routine for working out the unknown factor given any three of four — principal, interest rate, time and repayments. The program prompts for each entry in turn and the unknown is entered as 0. Once the details have been entered the user is asked whether it is a bank loan or mortgage and the full details are displayed, including the missing factor.

A password can be specified by choosing option 4 on the main menu and entering the choice in response to the prompt. That is then saved with the program in both the save options and requested when the saved program is loaded. The save-to-Microdive routine thoughtfully displays a warning that the program will crash if the Microdive and cartridge are not connected.

A useful facility to search the data for an entry is included at option 8. The subsidiary menu allows the data to be searched by either its details or by the amount. One annoying point is that although when entering a transaction the amounts are positive, when searching the minus sign must be included for debits. Once the characteristic has been specified the program displays the data, details and amount of all entries.

With Cash Controller, Shepherd has produced a useful package for the home finance market. The error-trapping is good and allows bad errors to be corrected without causing damage to the data or program, although there are one or two areas for improvement.

Perhaps the biggest disadvantage is the statement request routine which needs to scan the whole data day by day for the specified period. For large amounts of data or long periods that takes an inordinate amount of time.

One point which the more astute may have already realised is that although Cash Controller is loaded as a machine code program, it can be listed as a Basic program. That seems to be because of Microdrive compatibility.

Cash Controller can be obtained from *Richard Shepherd Software Ltd, 22 Green Leys, Maidenhead, Berkshire. It costs £9.95.*

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EDUCATION

Decision-makers

Strategy and adventure games introduce children to problem-solving. Theodora Wood explores some educational worlds

MANY EDUCATIONAL programs produced so far rely on the question-and-answer format, using the computer as a vehicle to test a child's competence in a certain area and, by imaginative use of colour, graphics and sound, sugar the pill of mental arithmetic and spelling and act as revision notebooks. Doing that they echo the traditional methods of teaching using textbooks and workbooks.

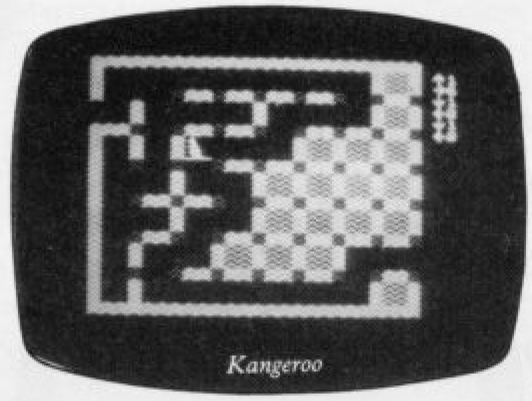
There is, however, an alternative method of using the computer, creating situations whereby the user has to determine the best method of solving the problem and, in so doing, is involved in a decision-making process rather than reiterating answers learned by rote. In such situations a child's approach is dominated not so much by finding the correct answer as by testing various strategies which might work to a greater or lesser degree. In those situations incorrect answers are as thought-provoking as their correct counterparts and provide a basis from which to work towards a better solution.

Pathfinder — Spectrum 16/48K, Widgit, £5.95 — is an introduction to problem-solving techniques for younger children. All the programs reinforce left/right orientation, an important pre-reading skill, as all four involve moving an animal/monster from the left to the right of the screen. Children as young as three years old will appreciate **Rabbit,** where the rabbit has to be moved through a simple maze by means of the cursor keys, without CAPS SHIFT, which makes it simpler.

As the rabbit moves, additional visual stimulus is provided by the fact that it eats the carrots in its path and thus delineates the moves already taken, and each movement is accompanied by a clicking sound different for each direction. The mazes are generated at random, so there is no opportunity to learn the way through by memory and that is the case for other programs.

Kangaroo poses a slightly more difficult problem as the kangaroo has to be programmed to move through the maze by means of the cursor keys, followed by the number of steps in any direction. Any number of moves can be programmed before pressing G to execute the program. If there has been an error, the program which is listed on the side of the screen returns to the place before the mistake, so no editing is required. Kangaroo introduces the concept of a program and RUNning it in a visually-stimulating context and enables a child to conceive very simple programs with no need for text entry.

A hungry monster must find its way through the park, picking up food in a certain order in **Picnic.** There are two levels of difficulty and the monster can-



Kangeroo

not retrace its steps, so some forward planning is required. Successful completion of the task is accompanied by the screen filling with monsters and food, together with appropriate sounds.

Frogs is similar to Picnic but there the problem is to pick up other frogs and avoid the water lilies without retracing the steps taken.

Pathfinder is an excellent introduction to spatial concepts and logical processes for children aged between three and eight. It has two qualities which make it more useful than its pen-and-paper equivalent; the mazes are generated at random and there is no possibility of wandering across the walls with a pencil, as young children are prone to do.

Widgit continues to develop a learner-orientated strategy with **The Humpty Dumpty Mystery** — Spectrum 48K £6.25 — produced in collaboration with Gordon Askew. The object is to discover who pushed Humpty Dumpty off the wall. Humpty Dumpty falls from the wall together with the nursery rhyme and then the 12 suspects appear on the screen. They are all soldiers, each with various coloured hats, jackets and badges.

The child has the choice of a question or guess. If Q for question is ENTERed the words "Did he have" appear at the bottom of the screen and the child has to finish the question with, for example, a red jacket. If the answer is no, all the soldiers with red jackets are eliminated from the screen. By that process the guilty party can be found.

The game can be played on two levels of difficulty, either easy or difficult. The easy mode allows for single-key entry so that colours can be ENTERed using the Spectrum colour keys and nouns by their initial letter; the difficult mode requires whole words to be typed-in. Thus the game can be played by children who may find difficulty with spelling and use of the keyboard. A score appears at the end of the game and the best score in the playing session is displayed.

Game two can be LOADed from an option in the first game. This time the child has a glimpse of the culprit behind the wall and then has to fill in the colours of his hat, badge, eyes, mouth and jacket. Single-key or whole-word entry and two levels of difficulty operate as in game one. The format encourages observation and memory skills in an entertaining way.

'The programs lend themselves to group usage and by discussing the next move children can learn from each other'

Who Killed Cock Robin? uses the nursery rhyme as a basis for an opportunity for children to play detectives, working out clues and going through the logical process of deduction required to solve the mystery. A choice can be made of three, four, five or six suspects, locations or times, and 10

continued on page 119



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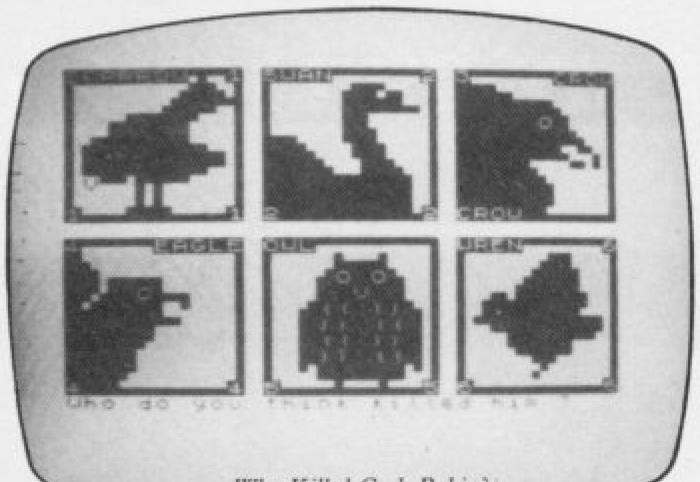
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Who Killed Cock Robin?

continued from page 117

attempts are given for each game. At each attempt the child is asked to guess the culprit from among the suspects.

Named and numbered pictures of each animal or bird appear on the screen, each well-realised in silhouette form. The locations appear next, each its own little gem of a picture, and then the time by means of clock faces. Each run through the options and the number of correct guesses is recorded, for example RAT FARMYARD 12PM, one correct.

A clue can be taken, after each attempt, for who, where and when. A score is shown after each game and the best score is displayed. Groups of children find it particularly entertaining and much heated discussion can take place about the clues and the strategy for the next attempt.

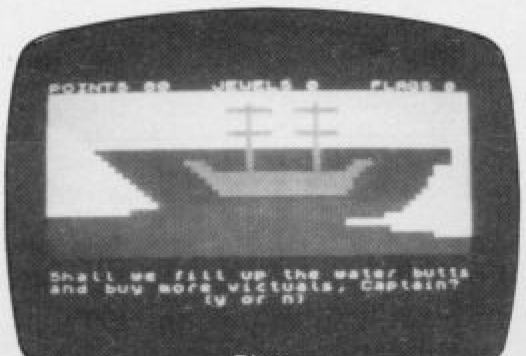
Pirate — Spectrum 48K, Chalksoft, £8.25 — introduces the strategy-solving possibilities of an adventure game to children who are too young to cope with the rigours of an adult adventure game. The adventure is in two parts and entry to part two is dependent on gaining sufficient jewels and magic objects — all the ingredients of a full-blown adventure.

Instructions are shown before the adventure begins; the child is the captain of a pirate ship and has to steer round the ocean; to win jewels it is necessary to win battles with other pirate ships or find them in one of the islands.

The captain is responsible for making decisions at each move, so that each move involves a strategic choice. The main difference between Pirate and adventures such as **The Hobbit** is that, instead of being asked 'What next?' the player has only to decide a direction north, south, east or west operated on the cursor keys, or is presented with a question such as 'Pirate ship dead ahead, do you want to give chase? y/n'.

Hazards include rocks, squalls, mutiny by the crew, being captured by the other pirates and being made to walk the plank; in the latter case that means the end of the particular game and the player has to return to the beginning of the game, which is different every time.

Positions in part one of the game can be SAVEd on to tape, which allows the player to retain jewels, flags and points. Each move is presented with a graphic portrayal of the situation; some of the rocks look particularly nasty and battles are shown by multi-coloured changes in the top half of the screen accompanied by a flurry of beeps. Other sound additions include renderings of *A Life on the Ocean Wave.*



Pirate

All instructions for SAVEing the position on tape and continuing to part two are given on-screen in a clear way and children who have regular access to a Spectrum should find no difficulty in operating those parts of the program.

Pirate is essentially a maze program with the added difficulty of acting virtually blindfold and involves a child not only in strategic decision-making but also in visualisation techniques and direction finding — at the least learning the points of the compass and their relation to one another.

While Pirate operates in the fantasy world of pirates and magic objects, **Inkosi** — Spectrum 48K, Chalksoft, £5.95 — is a simulation game operating in the world of ancient Africa. The object is for the tribe to survive and prosper under the king's leadership for 10 years and the user is the king. Decisions have to be made at the beginning of each year based on the number of people in the tribe, the amount of maize and the number of living cows.

Maize can be either planted, sown or traded for cows, and cows can be killed for food. One sack of maize will feed one person for a year while a cow will feed two. Once those decisions are taken, the year runs its course with random happenings occurring, such as lion attacks and the witch doctor demanding to kill cows in a fertility rite.

The game is finished if the tribe grows to more than 3,000 or if more than one-third die of starvation in one year. The outstanding lesson to be learned is that however good the planning at the beginning of the year, all can disappear if there is a drought or the fertility rites are too successful. Prosperity is dependent on luck as much as if not more than good management.

Relying as it does on text with few graphics and with little interaction apart from the planning phase, Inkosi offers a poor learning situation in comparison with simulation programs such as the Heinemann **Ballooning.** The use of a stereotyped situation such as ancient Africa, witch doctors, fertility rites, is not to be particularly recommended either.

The programs reviewed demonstrate various ways in which the Spectrum can be used to encourage children to develop the problem-solving strategies exemplified by Logo, requiring a learner-orientated technique not found in rule and drill packages. They also lend themselves to group usage, stimulating social interaction in a learning situation, and by discussing the next move children can learn from each other as much as from the program involved.

With the advent of the QL with its bigger memory, we can expect to see vastly more complex and imaginative uses made of the ability of the computer to present such situations and develop an interactive learning formula.

Title	Machine	Publisher	Price	Gilbert Factor
Pathfinder	Spectrum 48K	Widgit	£5.95	7
Humpty Dumpty	Spectrum 48K	Widgit	£6.25	8
Pirate	Spectrum 48K	Chalksoft	£8.25	7
Inkosi	Spectrum 48K	Chalksoft	£5.95	5


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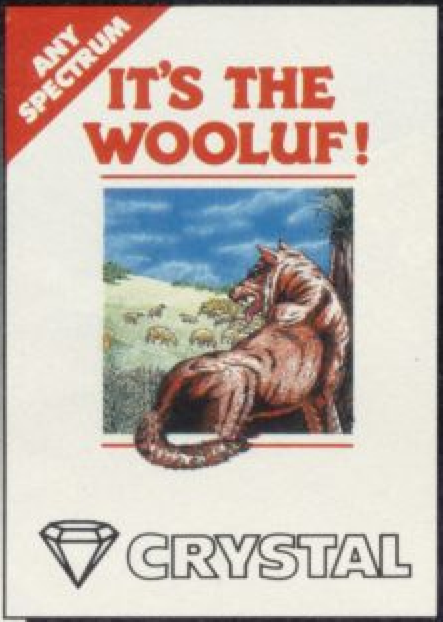
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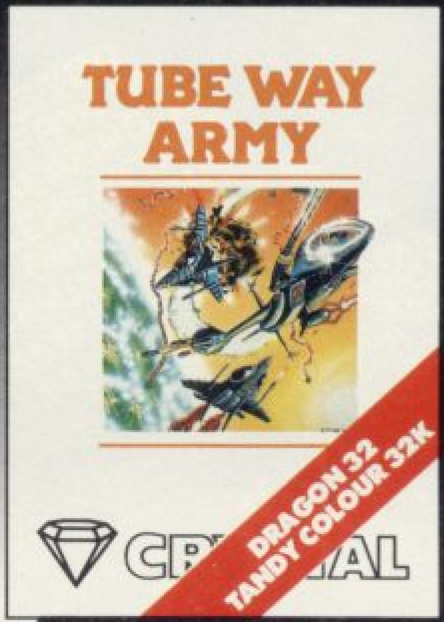
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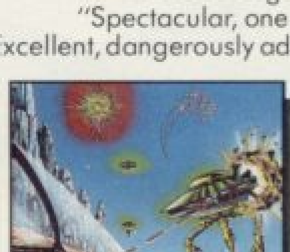
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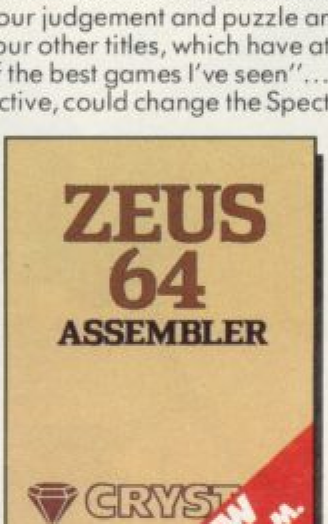
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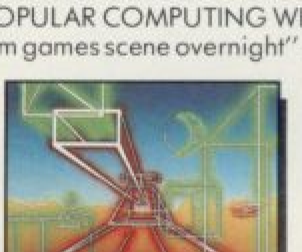
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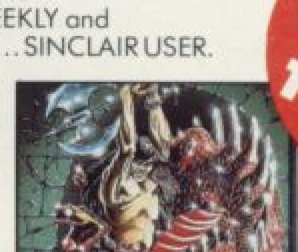
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Difficulties with odd characters

Andrew Hewson intrigued by printer buffer

ONE OF the difficulties of writing a regular column on a popular subject is that if I make a mistake my letterbox reverberates as correspondents from far and near hasten to correct my error and I have to hide from a postman weighed down with mail. So will all those readers who have been POKEing their Spectrums to determine whether they have Issue 2 or Issue 3 machines according to my advice in the January issue of *Sinclair User* please cease writing to ask what I was talking about? What I wrote was incorrect and I apologise for the confusion.

I was attempting to describe the difference between the most recent form of the Spectrum, the Issue 3 machine, and its predecessor in terms of a subtle difference in their response to the IN command. In fact, a much more straightforward method is to look through the slot in the rear where the edge connector is situated. In the latest models an aluminium heatsink about 12cm. long and 2cm. wide is clearly visible situated above the printed circuit board. That heatsink is absent from Issue 2 machines.

Incidentally, the 48K form of the first version of the Spectrum, Issue 1, made use of the space now occupied by the heatsink for a 32K memory board. In the re-design which resulted in Issue 2, sufficient space was found on the main board for the extra memory.

Doreen Fusco of Swindon has brought an unusual effect to my attention. She writes: **I was poking about in the printer buffer of my ZX-81 when I discovered that if I altered the contents of the final byte my printer produced double-height characters. I knew this could be done in machine code but I was surprised to discover it was possible from Basic, too. What is happening?**

I was intrigued by the letter and I soon discovered that a simple ZX-81 routine of the form:

```
10  POKE 16476,0
20  LPRINT "DOUBLE HEIGHT"
```

would produce double-height printer output.

The reason is that the relevant ROM routine uses the newline character—CODE 118—which is held at address 16476 to indicate the end of the information to be posted to the printer. The routine scans through the printer buffer eight times, working out, with the aid of the character table, the form of the top eighth of each character, then the second eighth, then the third eighth and so on.

In between each line of eighths the routine sends a signal to the printer causing it to slow the rate at which the printer motor turns. When the routine has gathered all the information for the next line of eighths, a second signal is sent, causing the motor to increase speed again. It is that staccato effect which causes the printer to sound like an asthmatic old man.

Changing the contents of 16476 causes the ROM routine to omit, among other things, to send the slow-down

> 'Unfortunately the routine picks up other information'

signal to the printer, hence more paper is wound past the printing head in between eighths, giving the appearance of double-height characters. Unfortunately in the absence of the newline character, the routine picks up other extraneous information which results in nonsense characters also appearing on the output. I can see no way round the difficulty and I would be interested to hear from anyone who can. In the meantime, however, there appears to be no way of putting the effect to good use.

John Heritage of Ashford, Kent, is clearly using his computer for financial calculations. He asks: **How can I reduce the answer to a calculation to two decimal places and how can I ensure that the decimal points in a vertical line of figures always lie below one another?**

As is so often the case, the answer to each of the questions is straightforward, once the general principle is understood. In the first case the INT function, which rounds down a decimal number to the nearest whole number, can be used to round down to two decimal places, simply by multiplying beforehand by 100 and dividing by the same number afterwards.

In the second case, the number can be converted to a string using the STR$

continued on page 127

```
10  LET D$ = "."
20  INPUT I
30  LET I = INT (100 * I + 0.5) / 100
40  LET Z$ = STR$ I
50  FOR J = 1 TO LEN Z$
60  IF Z$ (J) = D$ THEN GOTO 80
70  NEXT J
80  PRINT AT 21, 16 - J; Z$
90  INPUT "33 spaces";
100 GOTO 20
```

Table 1. A Spectrum routine which rounds the contents of I to two decimal places and PRINTs the result with decimal point in column 16. To adapt the routine for the ZX-81, change line 90 to read 90 SCROLL.



● *Please address problems and queries to Andrew Hewson, Helpline, Graham Close, Blewbury, Oxfordshire.*

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function and then the string can be searched to identify the position of the decimal point. A simple calculation will then ensure that the number is PRINTed with the decimal point in the correct column.

The program in table one shows those principles in practice. Notice that the variable I is increased by five in the equivalent of the third decimal place in line 30 to counteract the effect of the INT function rounding downwards. Thus, for example, a value of 3.648 is rounded up, correctly, to 3.65 by that line, whereas 3.642 is rounded down to 3.64.

Incidentally, a number should be rounded only immediately before it is PRINTed and not at intermediate stages of a calculation. If the number is to be used on a subsequent occasion the unrounded form should be stored in a separate variable. Alastair Baird of Hartfield raises an interesting topic. He writes: **I wish to store some information above RAMTOP on my 48K Spectrum and to clear out the user-defined graphics, I entered CLEAR 65535: NEW: CLEAR 60000: NEW. Imagine my surprise when I found that the lowest 104 bytes were set to zero but the remaining 64 bytes — 65472 to 65535 — still contained non-zero values. Can you explain?**

Computer memory is rather like a blackboard; it is of limited size and to accommodate new information it is usually necessary to erase information which has become redundant. There are two principal methods which a computer can use to update its blackboard. Either it can erase information as soon as it has become redundant and move all current information into one block, so as to accumulate all spare memory in one place, or it can ignore the problem and over-write redundant information the next time it wants to use the space.

'Computer memory is rather like a blackboard'

The first method has the advantage of minimising the total amount of memory required but the disadvantage that current information is forever being shuffled around in memory — in the jargon of the computer trade that activity is called garbage collection. The second method has the advantage of speed but the disadvantage that unless the software keeps a careful note of the situation, portions of memory can become clogged with redundant information.

```
10 FOR I = 23296 TO 23551
20 INPUT Z$
30 IF Z$ = "S" THEN STOP
40 PRINT Z$
50 LET Z$(1) = CHR$ (CODE Z$(1) -
   7*(CODE Z$(1) > 57))
60 LET Z$(2) = CHR$ (CODE Z$(2) -
   7*(CODE Z$(2) > 57))
70 POKE I, 16*CODE Z$(1) + CODE Z$(2)
   - 816
80 NEXT I
```

Table 3. A Spectrum program to load pairs of hexadecimal codes into the printer buffer.

The ZX-81 and the Spectrum use the first method to an obsessive degree, fussing around like a nervous squirrel hoarding memory at every opportunity. As a result, Basic programs tend to run slower than on other machines.

In the case of Baird's problem, the Spectrum omits to re-set a portion of memory which it will not be accessing in future. The two instructions CLEAR 65535 : NEW delete the user-defined graphics area as required but the machine then establishes its stack at 65535 working downwards; the machine stack is used to hold the return addresses of ROM routines being executed and other vital but temporary information.

Entering CLEAR 60000 : NEW subsequently moves down the stack but leaves a frozen copy of it in the 64 bytes at 65472 to 65535, as Baird discovered. The only solution is for the user to delete the data, a fairly simple matter using either a Basic or a machine code routine.

Wim Gulpen of the Netherlands brings an international flavour to the column. He asks: **Can you provide a Spectrum machine code routine to scroll the top eight lines of the display only? I have written a Basic routine but it is too slow.**

To answer the question I have adapted two routines which appear in *40 Best Machine Code Routines for the ZX Spectrum,* a book I wrote with John Hardman. The routines are listed together in table two. The first part scrolls the display file and the remainder scrolls the attributes. The eighth line of the display is cleared and its attributes set to the value held in the system variable ATTR P.

The routines can be loaded into the Spectrum printer buffer using an assembler or the Basic hexadecimal loader program listed in table three. Call the routines by entering:

RANDOMIZE USR 23296

Hexadecimal		Assembler	Comment
11 00 40		ld de,16384	Top lhs of first line
21 20 40		ld hl,16416	Top lhs of secod line
06 08		ld b,8	Number of lines
C5	NXTBLK	push bc	Save number of lines
01 E0 00		ld bc,224	7 lines each 32 characters long
ED B0		ldir	Copy (hl) to (de)
06 20		ld b,32	Length of last line
3E 00		ld a,0	Clear a register
12	LASTLIN	ld (de),a	Clear last line
13		inc de	
23		inc hl	
10 FB		djnz LASTLIN	
C1		pop bc	Recover number of lines
10 EE		djnz NXTBLK	Decrement and jump if not zero
01 EO 00		ld bc,224	7 lines each 32 characters long
11 00 58		ld de,22528	First line of attributes file
21 20 58		ld hl,22560	Second line of attributes file
ED B0		ldir	Copy (hl) to (de)
3A 8D 5C		ld a,(23693)	Value of ATTR P to a register
06 20		ld b,32	Length of last line
12	LASTATTR	ld (de),a	Clear last line
13		inc de	
10 FC		djnz LASTATTR	Repeat if not zero
C9		ret	Return

Table 2. A Spectrum program to scroll the top eight lines of the screen display.

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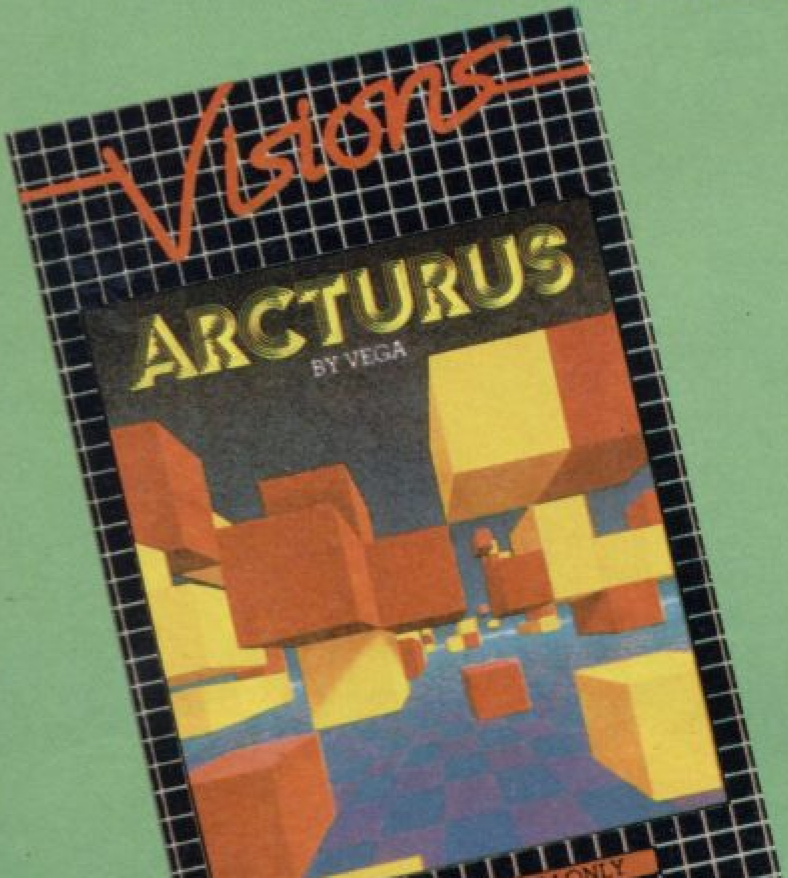
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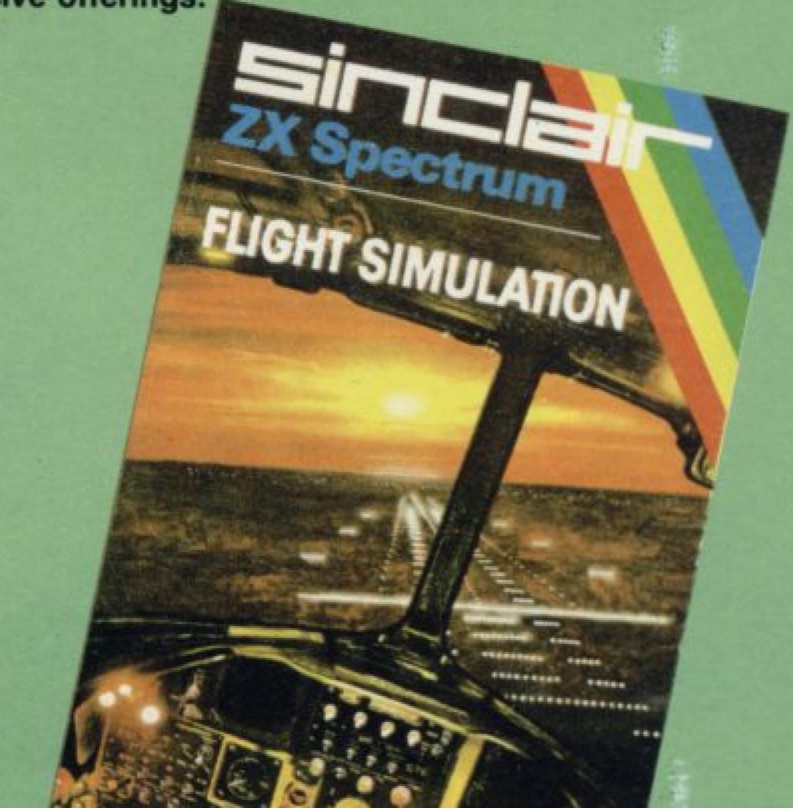
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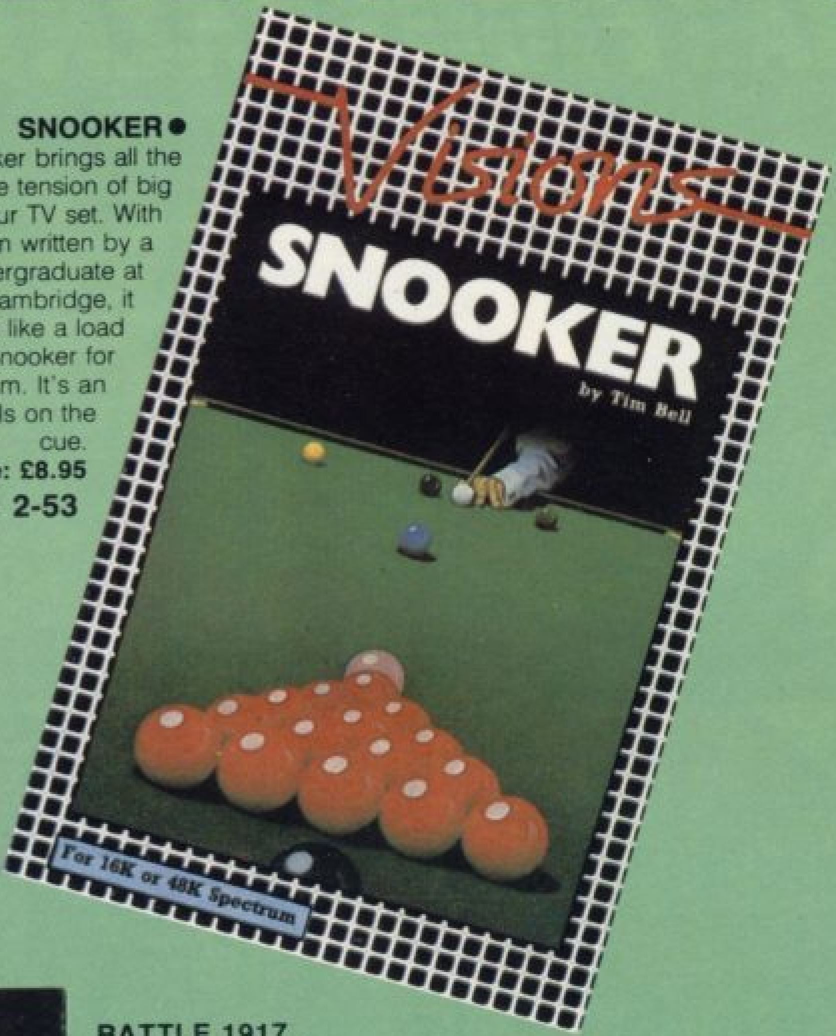
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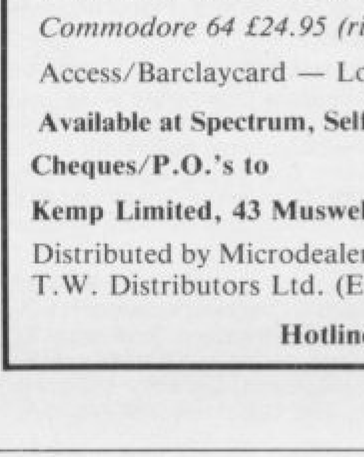
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PICTURESQUE

Climbing the tree of knowledge

Quentin Heath reveals methods of making computers seem intelligent

SEVERAL MONTHS ago I promised an occasional series of articles about the programming techniques used in such games as chess, battle strategy and adventure. For those who have waited patiently for the series I fulfil the promise.

Every mind game has a definite structure. It is that structure which determines not only how good the game is but also the way in which it plays.

Many types of game have been explored in this column so it will be an interesting exercise to see the techniques in action and will also provide you with an excuse to polish your programming techniques.

The technique which is the most important in artificial intelligence games is tree structuring. It is the structure which is most used and most useful to the chess programmer. It is one way in which data concerning the state of the game and the usefulness of certain moves is contained in the computer. By manipulating the data, the computer will be able to see which move is best to force a win against a human player.

A typical tree is shown in figure one. It has been pruned for the sake of simplicity but as a game of chess is played it would grow longer. The tree is odd-looking because it has a root at the top and branches which creep down towards the bottom of the page. Each circle which connects one branch to another is called a node—a point where a decision has to be taken by the computer. It has to decide which branch it should take next in its quest down to the end of the structure.

Each level of nodes, on a horizontal plane, is called a ply and the first of those starts after the root. The tree in the illustration is only one example of the many arrangements which can be formed by a computer in its quest for the winning move.

The use of a tree is an involved process which only a computer could handle. An average tree can run into hundreds of plys and thousands of nodes. It would take a human several weeks to work through a tree but would take a computer only two seconds, depending on the skill level at which the computer can be set. When a computer game starts, the tree structure does not exist. It is built in the RAM of the machine as the computer plays its strategy. All that exists is the root node at the top of the tree which usually points to the address at which the tree is stored in memory.

Two subroutines must exist in some form in a program, called the legal move generator and the evaluation module. Both units aid the computer to create a tree which will play a winning game.

When the computer starts to play, the first thing it seeks is a table of all the possible moves on the board from the legal move generator. The generator finds all the starting moves and produces the first ply of branches from the root of the tree. There may be only a few starting moves, like a game of Nim,

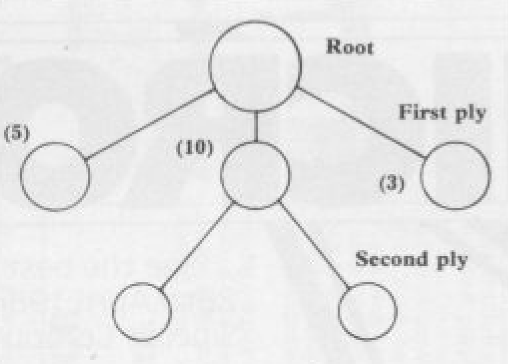


Figure 1. Development of a tree.

or many moves, as in chess, but the computer does not mind. In the fictitious game tree in figure one there are three possible starting positions. They will form the basis for the next move of the computer.

The evaluation module finds which move is closest to the best from all the possible moves. Usually it does so by giving each possible move a score. For instance, in figure one the left-hand node move has been given the score 5, the middle 10 and the right 3. That means that the most promising move is the middle one. The middle node of the first ply then becomes a new root and the computer moves down the tree.

When the evaluator has made its decision, the computer decides whether it has won the game. If it has, it can finish its tree, make the final move and inform the user. If the winning move has not been found, the computer will return to the legal move generator, use the last move root, in the middle, as a root and produce branches again for the possible moves. Once found, those moves will be evaluated as with the first ply and if a winning move is not found, the computer will generate yet another ply of possible moves.

The representation of a tree in the computer memory does not look like that in the diagram. It would be represented as a table of numbers if the game is in machine code, or numbers in an array if the program is in Basic.

You might have guessed that as the computer could create some massive trees the program could run out of computer memory and be unable to continue the game. There is an easy way to circumvent the problem and that is to prune the tree.

The tree search is a heuristic technique. Using it the computer has to learn from its mistakes and make judgments on the data it has collected. There is another type of technique, an algorithm, in which a ready-made solution is built into the program and the computer follows that to the end and a win.

It is done by cutting away the branches of the tree which are no longer important. They would include all nodes before the current root and those branches and nodes which have been eliminated and not continued. The pruning would free space in memory for extra branches and keep the amount of data which the computer has to sort to a minimum. The computer usually will start its pruning procedures after a certain number of plys have been created. That depends on the type of game and more plys would be needed in chess than in Noughts and Crosses or Nim.

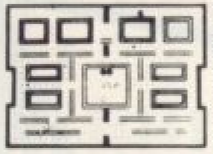
As you can see, the tree structure relies heavily on the legal move generator and the evaluation module. It is those parts of a game program which give the computer its strategic playing power and govern the rules by which the computer fights its duel with the human challenger.

In the next of this occasional series I will examine both those subroutines and see how they affect the performance of a computer which is interested in winning. I will also try to find whether the programmer or the computer makes a chess program a champion.

Next month I will step back into the past and investigate the myth of Perseus and Andromeda, as told by Digital Fantasia.

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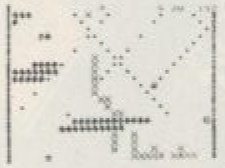
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TORTRAIL & TORTMAZE: 16K games using the forward, left and right commands. These are good for learning a feeling for distances and angles and are fun to play.
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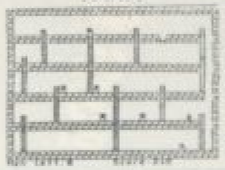
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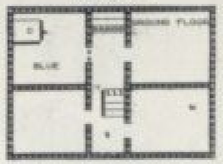
CENTIPOID (machine code).
Centipoid is a full-feature arcade game with mushrooms, spiders, webs, scorpions, gobblers, indestructible dead segments of centipoids that drop down on you, and, of course, the centipoids themselves.
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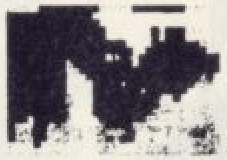
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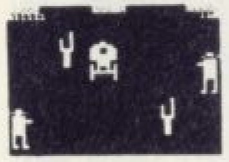
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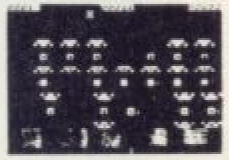
ZX-SCRAMBLE with 3 stages.
(machine code) Bomb and shoot your way through the fortified caves.

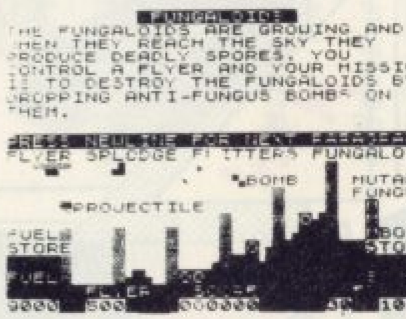


GUNFIGHT (machine code)



INVADERS (machine code)





GALAXY INVADERS (machine code)
Fleets of swooping and diving alien craft to fight off.

SNAKEBITE (machine code)
Eat the snake before it eats you. Variable speed (very fast at top speed).

LIFE (machine code)
A ZX-81 version of the well known game.

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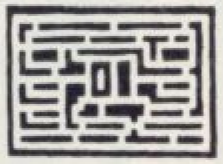
"Easy to operate, graphically impressive and good value for money."
The Times, 11th Dec '82

"Definitely good value for money at £6 . . . A smooth clear display and a relatively fast response from the keys. Graphics are as good as you will ever get on the 81."
What Micro? Nov '83

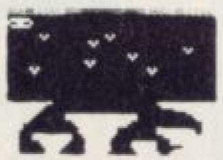
7 of the 8 games are in machine code, because this is much faster than Basic.
(Some of these games were previously available form J. Steadman).

CASSETTE 5 8 games for 16K ZX-81 £6

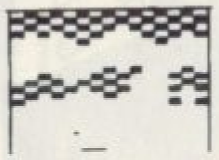
BYTE-MAN (machine code)
(previously available from Mindseye)



SPACE RESCUE (machine code)
(previously available from Mindseye)



BREAKOUT (machine code)



BLITZ (machine code)



PLANETOIDS (machine code)
Rotate, move, fire and hyper-space controls. Wide range of choice of speed and difficulty.

DODGEMS (machine code)
Dodge the computer's car while eating the dots.

DRAUGHTS (machine code)
Three skill levels.

MERCHANT (Basic)
Make your fortune on trading voyages in the Mediterranean and beyond.

"New polish on old favourites. . . . the quality of the software and the smooth action displays created on the screen make the programs worthwhile for anyone who has a ZX-81 and plays games using it. . . . It is pleasant to see that Orwin's kind of quality is available again."
Sinclair User, Sept '83

"Among the best reviewed was Cassette 5 from Orwin Software. For a mere £6, you get eight top-quality games . . . All the games are of very high quality and would cost £4 or £5 if sold separately . . . Many of the other software houses could learn a lesson from these."
What Micro? Games supplement, Nov '83

7 of the 8 games are in machine code because it is much faster than Basic.

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BEYOND
CHALLENGING SOFTWARE
NEW
PSYTRON
Matter Disruptor complex report terminated: Estimate 75 personnel unaccounted for: Repair and medi-crews alerted: Defence circuits detect responsible alien craft now locked onto new target: Saboteur sighted in central corridor Sector 7: Pursuit Droid activated: Switching to visual:::
Disruptor unstable! Detonation immin......
Spectrum
From the Necromancer's Cauldron...
...Were conjured the ghouls, ghosts and outraged spirits of centuries of sacrifices to the occult. Hurled forth from who-knew-whence to thwart your escape down the perilous fortress steps. An ill-timed move will plunge you into his waiting spider's tangled web. 12 levels of haunting action.
Spectrum
NEW
Spellbound
Spells
NEW
The War of the Solstice will commence!
the Lords of Midnight
Gather those you can to your banner. The World's first Epic game. Not an adventure but a living fantasy novel. And you are the author of the action.
Spectrum

CASSETTE ROUND-UP

If we have reviewed a cassette we have given it a rating known as the Gilbert Factor. That factor includes value for money, the screen layout, the conciseness and speed of the program, the accomplishment of the task it aims to achieve, and the use it makes of the machine.

ZX-81

Adventure

Adventure 1	Abersoft	6
Barrow Quest	Sherry	*
Black Crystal	Carnell	7
Dr. Whom	D. Biggs	*
Dungeons of Doom	Woosoft	*
Espionage Island	Artic	*
Greedy Gulch	Phipps	7
Inca Curse	Sinclair	*
Knight's Quest	Phipps	*
Lost Island	JRS	*
Magic Mountain	Phipps	*
Merchant of Venus	Crystal	7
Pharoah's Tomb	Phipps	*
Pimania	Automata	*
Secret Valley	Newsoft	*
Serpents Tomb	Vortex	*
The Great Western	New Soft	*
Time Bandits	New Soft	*
Tomb of Dracula	Felix	*
Volcanic Dungeon	Carnell	*
World of Illusions	Constrast	4

Arcade

Alien Dropout	Silversoft	*
Asteroids	Silversoft	8
Asteroids	Software Farm	6
Astral Convoy	Vortex	*
Bank Robber	Romik	6
Bubble Bugs	Romik	6
Byter	Protek	*
Cassette 1	Orwin	7
Cassette 2-5	Orwin	7
Defenda	Quicksilva	8
Door Slammer	Cathedral	7
Froggy	DJL	7
Full-screen Breakout	New Generation	*
Galactic Trooper	Romik	6
Galaxy Jailbreak	Romik	6
Games	P Teakle	*
Games 2	JRS	*
Games Tape 1	J K Greye	*
Games Tape 2	J K Greye	*
Games Tape 3	J K Greye	*
Gobbleman	Artic	*
Gobbler	Software Farm	*
Grand Prix	dK' Tronics	*
Gulp 2	Campbell	*
Hang Glider	S Electronics	6
High-resolution Invaders	Odyssey	*
Invaders	Abersoft	*
Invaders	Bug-Byte	*
Invaders	Odyssey	8
Invaders	Selec	7
Invaders	Silversoft	*
Krazy Kong	PSS	*
Maze Death Race	PSS	*
Maze Man	Abersoft	*
Mazogs	Bug-Byte	*
Namtir Raiders	Artic	8
Night Gunner	Digital Int.	5
Puckman	Hewson	*
Six Games	A Stubbs	5
Space Raiders	Sinclair	*
Space Trek	JRS	*
Swag + Voyager	Howard	*
3D Monster Maze	New Generation	9
Three Games Cassette	McGraw Hill	8
Zuckman	DJL	8
ZX Invasion Force	Artic	*
ZX Panic	Selec	4
ZX-81 1K Games Pack	Crystal	9
ZX-81 Pocket Book	Phipps	*

Business

Accounts (Limited company)	Hestacrest	*
Accounts (Sole Trader)	Hestacrest	*
Business Bank Account	Transform	*
Critical Path Analysis	Hilderbay	6
Draft	Myrmidon	*
Mailing List	Hestacrest	*
Payroll	Hilderbay	*
Payroll	Soft Tech	*
Payroll	Soft Tech	*
Personal Banking System	Hilton	*
Purchase Ledger	Hestacrest	*
Sales Day Book	Transform	*
Sales Ledger	Hestacrest	*
Text	Contast	8

Education

Calpac 1-2	Calpac	*
Four Rules of Number	Micro Master	*
Integration	University	8
Intermediate English 1-2	Rose	*
Intermediate Maths 1-2	Rose	*
Language Devel. Series	Glasson	*
Language Devel. Series	Micro Master	*
Linear Programming	University	*
Matrix Operations	University	7
O Level Chemistry	Calpac	*
O Level French Revision	Rose	*
O Level Maths Revision	Rose	*
Polynomials	University	*
Primary Arithmetic	Rose	*
Regression	University	*
Self-teach Program	Anvil	*

Language

Forth	Sinclair	7
ZX Forth	Artic	8

Practical

Football Pools	Hartland	*

Puzzle

Nowotnik Puzzle	Phipps	*
Word Fit	Ram Writer	6

Simulation

Fighter Pilot	Digital Int.	5
Flight Simulation	Sinclair	6
Pilot	Hewson	7
Print Shop	CCS	*

Strategy

Airline	CCS	7
Auto Chef	CCS	*
Bank Raid	J M Senior	*
Battleships	JRS	*
Conflict	Martech	7
Cyborg Wars	Stratagem	7
Dallas	CCS	6
Farmer	CCS	*
Football Manager	Addictive Gms.	*
Fort Apache	Contrast	8
Great Britain Ltd	Hessel	*
The Settler	BSS	*

Traditional

Do Not Pass Go	Work Force	*
Original Superchess	CP Software	*
Othello	M.O.I.	*
Tai	PSS	*
Tenpin	Phipps	*
ZX 1K Chess	Artic	*
ZX-Chess I	Artic	*

Utility

Graphics	IPA	*
Graphics Toolkit	JRS	9
Machine Code Test Tool	OCP	*
MCoder	PSS	8
Programme Enhancement Package	R and R	*
Renumber Delete	Work Force	*
Sideways Copy	D King	*
Trace	Texgate	7
ZX Compiler	Silversoft	*
ZX Screenkit	Picturesque	*
ZX-81 Remload	Picturesque	*
ZX-Bug	Artic	*
ZX-sideprint	Microsphere	*
ZXAS	Bug-Byte	*
ZXDB	Bug-Byte	*

SPECTRUM 16K

Adventure

Android One	Vortex	*
Escape	New Generation	8
Mines of Saturn/Return to Earth	Mikro-Gen	*
Moria	Severn	*
Planet of Death	Artic	6
Secret Valley	Newsoft	*
The Great Western	New Soft	*
Time Bandits	New Soft	*

Arcade

Aquarius	Bug-Byte	6
Arcadia	Imagine	5
Arcadian	J K Greye	6
Assassin	Spectrasoft	*
Attack on New York	Fry	*
Avenger	Abacus	*
Baltic Patrol	E. Midland	*
Baron	Temptation	*
Base Invaders	Imagination	*
Black Hole	Quest	6
Blind Alley	Sunshine	7
Breakaway	Procom	*
Bug Blaster	Crystal	*
Cassette A	Orwin	*
Caterpillar	CDS	*
Cavern Fighter	Bug-Byte	4
Centi-bug	dK' Tronics	*
Children's Compendium	Dymond	*
City Defence	Mikro-Gen	*
Colour Clash	Romik	4
Cookie	Ultimate	*
Cosmic Guerilla	Crystal	8
Creepy Crawler	Mikro-Gen	*
Crevasse and Hotfoot	Microsphere	7
Cruising	Sunshine	4
Cyber Rats	Silversoft	7
Death Chase	Micromega	6
Demolition	Comp. Rentals	*
Destroyer	Winters	*
Digger Dan	Ocean	*
Dymonoids	Dymond	*
Earth Defence	Artic	5
Eskimo Eddie	Ocean	*
Family Games Pack	Hornby	*
Fireflash	Abacus	5
Froggy	DJL	7
Fruit Line	P A Hanson	*
Fruit Machine	dK' Tronics	6
Galactians	dK' Tronics	*
Galactic Trooper	Romik	3
Galactic Warriors	Abacus	6
Galaxians	Artic	6
Games Pack 1	A Burnham	*
Games Tape 1-2	Sospan	*
Ghost Hunt	PSS	*
Gnasher	R & R	8
Gobble-a-Ghost	CDS	*
Gobbleman	Artic	*
Godzilla and Martians	Temptation	7
Gorilla	D Hornsby	*
Ground Attack	Silversoft	6
Ground Force Zero	Titan	*
Gulpman	Campbell	*
Haunted Hedges	Micromega	6
Hopper	PSS	6
Horace and the Spiders	Sinclair	8
Horace Goes Skiing	Sinclair	8
Hungry Horace	Sinclair	8
Invasion Force	Artic	8
Jogger	Severn	*
Labyrinth	Axis	4
Leap Frog	CDS	*
Light Cycle	PSS	*

Luna Crabs	Micromega	7
Lunar Jetman	Ultimate	*
Magic Meanies	CDS	2
Maze Chase	Hewson	8
Meteor Madness	Spectresoft	*
Meteor Storm	Quicksilva	7
Meteoroids	dK' Tronics	7
Meteoroids	Softek	6
Millypede	Add-on	7
Mined Out	Quicksilva	7
Moon Buggy	Visions	*
Muncher	Silversoft	*
Muncher	Silversoft	6
Nanas	Mikro-Gen	*
Orbiter	Silversoft	7
Ostron	Softek	*
Pengy	Micromania	4
Pitman Seven	Visions	*
Planetoids	Sinclair	8
Proteus	Abacus	5
Rapedes	Visions	*
Repulsar	Softek	*
Rider	Virgin	6
Road Toad	DK Tronics	7
Robot Panic	Soft Mill	1
Santa	Artic	*
Sentinel	Abacus	7
Shark Attack	Romik	5
Sheer Panic	Visions	7
Shiva Special 1	Shiva	*
Sky Raider	C M Smith	*
Slippery Sid	Silversoft	8
Space Fighter	Winters	*
Space Intruders	QS	7
Space Lanes	Cathedral	*
Space Raiders	Sinclair	6
Space Zombies	Mikro-Gen	*
Spec. Frogs/ Showdown	Artic	*
Spec. Gobbleman	Artic	*
Spec. Invaders	Artic	*
Spec. Invasion Force	Artic	*
Spec. Scramble	Work Force	7
Spectipede	R and R	8
Spectral Invaders	Bug-Byte	8
Spectral Panic	Hewson	5
Spectres	Bug-Byte	6
Strike Four	Spectresoft	4
Styx	Bug-Byte	7
Sub	Romik	*
Tank Battle	dK' Tronics	8
The Devil Rides In	Carnell	*
3D Monster Chase	Romik	3
Train Game	Microsphere	9
Vortex	JK Greye	5
Winged Warlord	CDS	6
Wizard's Warriors	Abersoft	*
Yomp	Virgin	7

Business

Finance Manager	OCP	9
Home Computer Pack	SD Micro	*
Masterfile 16	Campbell	*
Matcalc	Work Force	*
Vu-Calc	Sinclair	7
Vu-File	Sinclair	8

Education

Alphabet	Widget	*
Alphabet Games	Sinclair	*
Apostrophe	Sinclair	7
Ballooning	Heinemann	*
Calpac 1-3	Calpac	*
Car Journey	Heinemann	*
Cargo	Sinclair	*
Counting	Starter Soft	*
Counting	Widget	*
Education One	Lerm	*
Educational	Startersoft	*
Firework Music	Soft Cottage	8
Four Rules of Number	Micro Master	*
French Voc Test	Tutorial	*
Hidden Letters	Poppy	*
Hot Dot Spotter	Longman	*
Integration	University	8
Intermediate English 1-2	Rose	*
Intermediate Maths 1-2	Rose	*
Language Devel. Series	Glasson	*
Language Devel. Series	Micro Master	*
Learn Basic	Logic 3	*
Learning Read 1	Poppy	*
Linear Programming	University	*
Marks Book	Lerm	*
Maths Tutor	AD Software	*
Matrix Operations	University	7
Money	Poppy	*
Night Sky	Bridge	*
Number 6	Prime	*
O Level Maths	Homestudy	*
O Level Physics	Homestudy	*
Pathfinder	Widget	*
Polynomials	University	8
Pre/early school cassettes	Essex	*
Primary Arithmetic	Rose	*
Punctuation Pete	Heinemann	*
Regression	University	8
Self-teach Program	Anvil	*
Shape Sorter	Widget	*
Special Agent	Heinemann	*
Spellbin	Startersoft	*
Teacheraid	B Farris	*
Use and Learn	Microl	8

Language

Beta Basic	Betasoft	9

Practical

Biorythms	Spectrasoft	*
Countries of the World	Hewson	8
Cycle Planner	Medidata	4
Shopping List	SD	*

Puzzle

Flippit	Sinclair	7
Lojix	Virgin	3
Nowotnik Puzzle	Phipps	7
Quazar	Rose	4

Simulation

Air Traffic Controller	Hewson	6
Airliner	Protek	6
Golf	R & R	7
Golf	Virgin	8
NightFlite	Hewson	5
Print Shop	CCS	8
Pro-Golf	Hornby	7

Strategy

Auto Chef	CCS	*
Big Match Soccer	Winters	*
Dallas	CCS	6
Dictator	Bug-Byte	*
Farmer	CCS	*
Football	Winters	*
Heathrow	Hewson	8
Las Vegas	Temptation	*
Quincy	Severn	*
The Settler	BSS	*

Traditional

Backgammon	Hewson	
Bridge Tutor	CP	8
Bridgemaster	Bridgemaster	9
Challenge	Temptation	*
Gambling Tape	Dymond	*
Odds-on	RSD	*
Othello	CP Software	*
Othello	M.O.I.	*
Pinball	Winters	*
Pool	Bug-Byte	7
Reversi	Sinclair	8
Roulette	Newsoft	*
Solo Whist	Video Soft.	*
Spec. Microchess	Artic	*
Super Play I	Video	*
Tennis	Winters	*

Utility

Aspect	Bug-Byte	5
Audio Sonics	Work Force	4
Character Generator	Spectrasoft	*
Designer	Matrix	*
Dietron	Custom	6
Disassembler	dK' Tronics	7
Display	Work Force	*
Editor/Assembler	Picturesque	8
Extended Basic	CP	7
FP Compiler	Softek	9
Keysounder	S and G	*
Machine Code Test Tool	OCP	7
Master Toolkit	OCP	*
MCoder	PSS	8
Micropen	Contrast	*
Peek	Zen	*
Print Utilities	Sinclair	*
Print Utilities	Sinclair	7
Programmer's Dream	Work Force	8
Renumber Delete	Work Force	*
Slow Loader	ELR	9
Sound FX	dK' Tronics	6
Spec. Bug	Artic	*
Spec. Editor/ Assembler	Picturesque	8
Spec. Monitor	Picturesque	8
Spec. Sound	M Afzal	*
Spec. Tape Copier	S Giza	*
Spectrum Super Toolkit	Nectarine	8
Spectsound	PDQ	2
Supercode	CP	*
Tape Breaker	Spectrasoft	*
Tape Copier	Lerm	*
Taswide-64	Tasman	*
The Key	Keysoft	*
Trace	Texgate	8
Trace	Zen	*
X Ray	Zen	*
ZXED	dK' Tronics	*

SPECTRUM 48K

Adventure

Abyss	CCS	6
Ace in the Hole	Add-on	*
Adventure 1	Abersoft	6
Adventure Island	Contrast	*
Alchemist	Imagine	*
Arcane Quest	Add-on	*
Black Crystal	Carnell	7
Black Dwarf's Lair	Newsoft	*
Black Planet	Phipps	7
Byte	CCS	*
Classic Adventure	Melbourne Hse	*
Colossal Caves	CP	8
Cry Wolf!	Add-on	*
Crypt	Carnell	6
Demon Lord	MCE	5
Detective	Arcade	7
Devils of Deep	Shephard	*
Diamond Quest	CCS	4
Diamond Trail	Gilsoft	7
Dragonsbane	QS	6
Dungeon Master	Crystal Comp.	8
Dungeons of Doom	Temptation	3
Espionage Island	Artic	5
Everest Ascent	Shepard	6
Fantasia Diamond	Hewson	*
Golden Apple	Artic	7
Gorgon	Phipps	*
Halls of Things	Crystal Comp.	9
Here comes the sun	Alligata	7
Hobbit	Sin/Melborne Hse.	9
Hole	Add-on	*
Horror Atoll	Add-on	*
Inca Curse	Sinclair	6
Invincible Island	Shephard	8
Island	Crystal	4
Island	Virgin	7
Jericho Road	Shards	*
Jungle Adventure	CCS	4
Knight's Quest	Phipps	6
Leopard Lord	Add-on	4
Lords of Time	Level Nine	8
Lost Over Bermuda	Add-on	*
Mad Martha	Miko-Gen	7
Mad Martha II	Mikro-Gen	*
Mountains of Ket	Incentive	8
Murder at Manor	Gemtime	7
Oracle's Cave	Doric	8
Pi-Eyed	Automata	6
Pimania	Automata	7
Quest	Hewson	7
Quetzalcoatl	Virgin	8
Roundsby Incident	Add-on	*
Satan's Pendulum	Minatron	7
Ship of Doom	Artic	7
Solaris	Softel	*
Superspy	Shepherd	5
Terror from The Deep	Add-on	*
The Castle	Bug-Byte	*
The Orb	Comp. Rentals	*
Time Quest	Mikro-Gen	*
Tomb of Dracula	Felix	*
Transylvanian Tower	Shepherd	7
Urban Upstart	Shepherd	*
Valhalla	Movisoft	7
Vampire Village	Terminal	4
Velnor's Lair	QS	8
Volcanic Dungeon	Carnell	6

Who Dares Wins	E. Midland	*
Wrath of Magra	Carnell	*
Ziggarat of Dread	Add-on	*

Arcade

Adven. St. Bernard	Carnell	7
Android Two	Vortex	*
Ant Attack	QS	8
Armageddon	Silversoft	3
Atic Atac	Ultimate	8
Base Invaders	Work Force	6
Bear Bovver	Artic	8
Birds and Bees	Bug-Byte	8
Blade Alley	PSS	*
Blue Thunder	R Wilcox	6
Brain Damage	Silversoft	*
Bubble Trouble	Arcade	*
Bugaboo	QS	7
Chequered Flag	Sinclair	8
Chuckie Egg	A & F	8
Chuckman	Add-on	*
Corridors of Genon	New Gen.	9
Cruise Attack	Mikro-Gen	*
Cyber Zone	Crystal	*
Deffendar	Mikro-Gen	*
Defusion	Incentive	6
Demon	Microcosm	*
Demon Chase	Mansfield	4
Devil Rides In	Carnell	7
Di-Lithium Lift	Hewson	*
Dimension Destructors	Artic	8
Dinky Digger	Postern	4
Dodge City	Phoenix	7
Elektro Storm	PSS	*
Fred	QS	*
Freez Beez	Silversoft	*
Galaxy Attack	Sunshine	4
Hickstead	CCS	4
High Noon	Work Force	9
House of Living Dead	Phipps	*
Hunchback	Ocean	*
Invasion Body Snatch.	Crystal	9
Jackpot	Comp. Rentals	*
Jet Pac	Ultimate	8
Killer Knight	Phipps	5
Knight Rider	Hewson	*
Krazy Kong	PSS	*
Last Sunset Lattica	Arcade	*
Lazatron	Contrast	*
Lazer Zone	QS	*
Loony Zoo	Phipps	6
Manic Miner	Bug-Byte	9
Maze Death Race	PSS	*
Maziacs	dK' Tronics	8
Monkey Biznes	Artic	7
Moon Alert	Ocean	*
Mr Wimpey	Ocean	7
Pat the Postman	Mikro-Gen	*
Penetrator	Melbourne Hse	7
Pi-Balled	Automata	7
Pssst	Ultimate	7
Pyramid	Fantasy	8
Raider Cursed Mine	Arcade	*
Rescue	Comp. Rentals	*
Rescue	Ocean	*
Robot Riot	Silversoft	*
Rommels Revenge	Crystal	8
Scuba Dive	Durrell	9
Security Shelter	Add-on	*
Skull	Games Machine	5
Space Station Zebra	Beyond	6
Spectron	Virgin	6
Splat	Incentive	8
The Guardian	PSS	6
The Pyramid	Fantasy	7
The Snowman	Quicksilva	8
3D Seiddab Attack	Hewson	5
3D Star Wars	Add-on	1
3D Tunnel	New Generation	9
Time Gate	QS	8
Tobor	Add-on	7
Tranz Am	Ultimate	*
Traxx	QS	7
Tube Train Terror	JRS	*
Tutankhamun	Micromania	8
Warlock of Firetop Mountain	Penguin	*
Wheelie	Microsphere	7
Xadom	QS	4

Business

Account Management System	Fulwood	*
Accounts (Limited Company)	Hestacrest	*
Accounts (Sole Trader)	Hestacrest	*
Address File	SD Micro	*
Address Manager	OCP	7
Bank Account System	K Gouldstone	8
Bank Verifier	SD Micro	*
Business Bank Account	Transform	*
Cash Controller	Shepherd	7
Collector's Pack	Sinclair	7
Critical Path Analysis	Hilderbay	*
Database	Microl	7
DIY Book-keeping	RAMTOP	*
Masterfile	Campbell	8
Omnicalc	Microsphere	9
Payroll	Hilderbay	9
Personal Banking System	Hilton	*
Personal Financ. Management Syst.	Fulwood	*
Sales Day Book	Transform	*
Spreadsheet	Microl	7
Tasword	Tasman	8
Tasword II	Tasman	9
Utility File	SD Micro	*
Word Processor	Microl	*

Education

ABC Liftoff	Longman	*
Angle	Chalksoft	5
Angle Turner	Arnold Wheaton	7
Astro Maths	Scisoft	6
Castle Spellerous	Sinclair	8
Chess Tutor 1	Sinclair	7
Countabout	Longman	*
French is Fun	CDS	5
French Mistress	Kosmos	*
French Voc Test	Tutorial	*
German Master	Kosmos	*
Guitar Tutor 1	Harlequin	*
Guitar Tutor 2	Harlequin	*
Handwriting	Chalksoft	*
Learn to Read 1-5	Sinclair	7
Magnets	Sinclair	*
Make-a-Chip	Sinclair	*
Mansfield Park	Sussex	7
Mathskills II	Griffin	7
Mr. Men	Mirror	*
Musicmaster	Sinclair	6
Nineteenth C. England	Sussex	8
O Level Chemistry	Calpac	*
O Level Physics	Think Tank	*
Party Time	C. Tutor	*
Pirate	Chalksoft	*
Quick Thinking	Mirror	*
Sequences	Chalksoft	5
Spanish Gold	Chalksoft	*
Speak and Spell	S and G	*
Speech Marks	Sinclair	7
Teach Data	B Farris	*
Teacher Data	B Farris	8
Tense French	Sulis	7
Whizz Kid	Comp. Tutor	*

Language

Forth	Melbourne Hse.	9
Forth	Sinclair	7
Micro Prolog	Sinclair	8
Pascal Compiler	Hi-Soft	*
Snail Logo	CP	8
Spec. Forth	Abersoft	9
Spec. Forth	CP	8
ZX Forth	Artic	8

Practical

Beamscan	Beamscan	9
Diet	dK' Tronics	*
Diet Master	Diet Master	6
Dietician	Keysoft	4
Engine Diagnostic	Spectrasoft	*
Football Pools	Hartland	*
I Ching	Salamander	7
I Ching	Sirius	*
Personal Reminder	SD Micro	*
Star Gazer	CRL	8
World Info	Wimsoft	*

Puzzle

Hanoi King	Contrast	*
Jumbly	dK' Tronics	*
3D Strategy	QS	8

Simulation

Fighter Pilot	Digital Int.	*
Flight Simulation	Sinclair	6
The Forest	Phipps	*
Golf	dK' Tronics	*
Inkos	Chalksoft	*
Royal Birkdale	Ocean	*
Test Match	Comp. Rentals	*
The Forest	Phipps	*
Troon	Hornby	8

Strategy

Airline	CCS	7
Apocalypse	Red Shift	*
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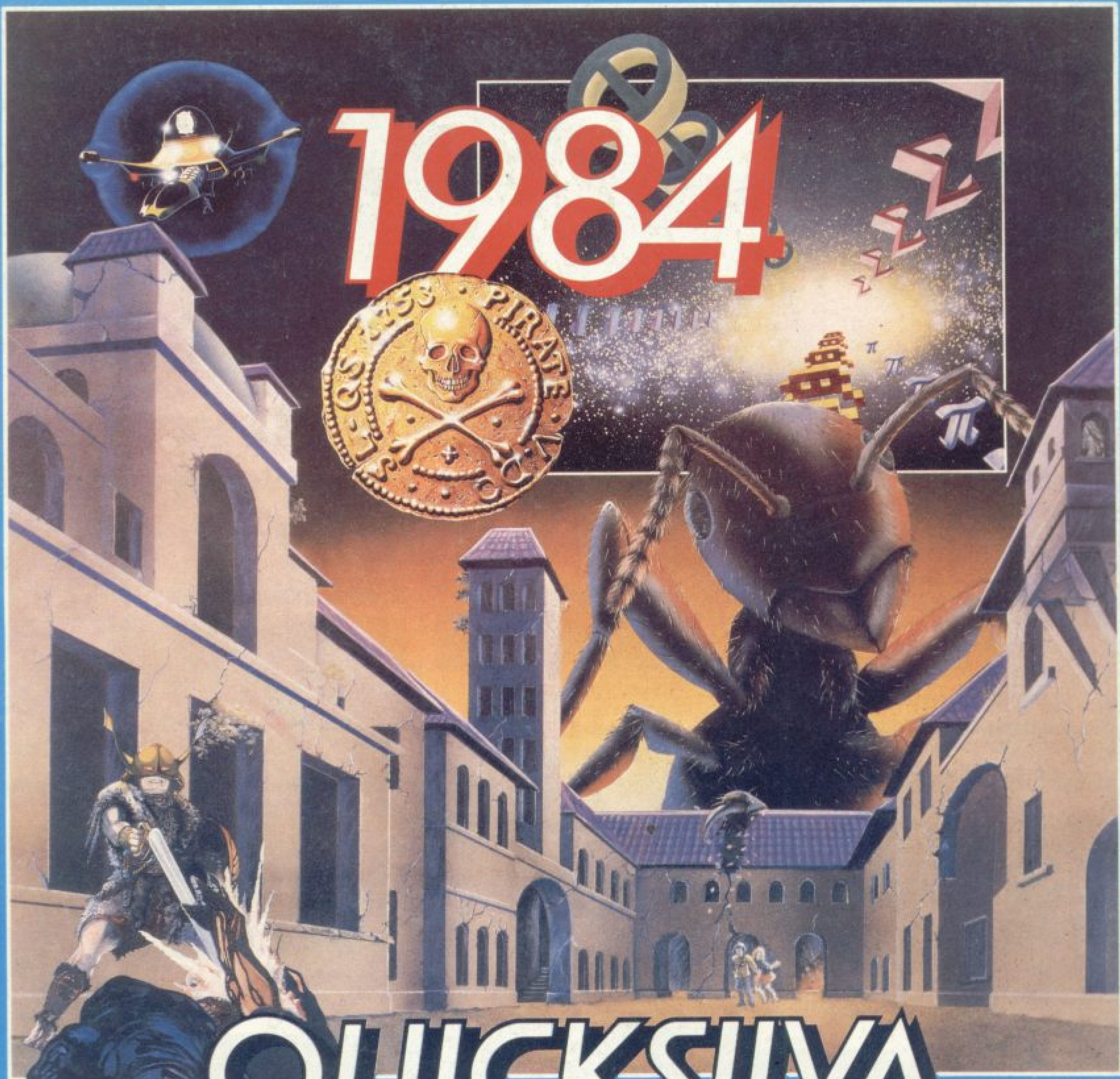
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